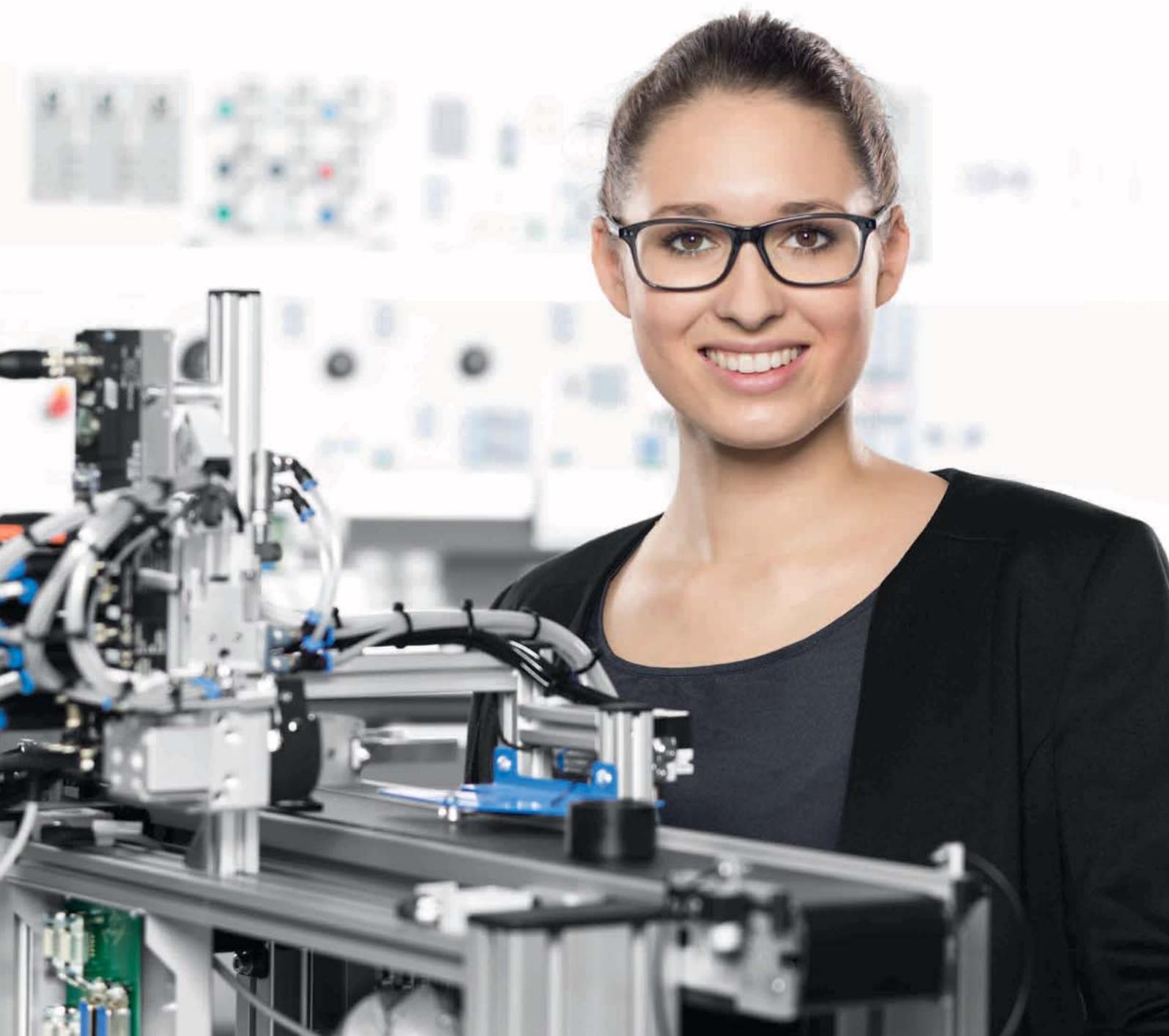


## Technology for education and science

The current range of Festo Didactic products

**FESTO**



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# Festo Didactic

Your ideal partner for vocational and further training





### **Learning, knowledge and education are major themes of this century**

Festo Didactic brings over 40 years' experience to the table when developing solutions for fast learning and successful retention for the entire spectrum of automation and technology. This expertise and experience puts us in a key position in the market of the future. Demand for training will continue to grow rapidly. And that's why we have set ourselves the goal of making learning ever more efficient. A great challenge for us. A great partner for you.

### **Everything from a single source**

The Learning System for Automation includes all current automation topics in its product range: pneumatics, electropneumatics, hydraulics, electrohydraulics, electronics, electrical engineering, sensors, robotics, CNC technology, PLC and fieldbus technology, manufacturing technology and process engineering as well as mechatronics.

### **From fundamentals to a complete training centre**

From basic training packages and technology-specific courses right through to the planning, control and handling of complex networked CIM systems and complete, fully furnished learning centres – we have created a world of learning for you which is tailored to your personal needs for efficient study and guaranteed learning success.

### **Your partner, worldwide**

We speak your language! And we're just around the corner – in more than 100 countries around the world. We'll gladly visit you at your office or home – whether you want to book courses or buy software, books or other products. Or perhaps you want to use the extensive range of online services – we're just a mouse click away!

### **[www.festo-didactic.com](http://www.festo-didactic.com)**

The Internet marketplace for education and training.

# Quality with a certificate

## Qualitäts-Zertifikat Quality Certificate

**FESTO**

DIN 55350-18-4.11

*CPV-14-V1*

Benennung / Typ  
Designation / Type

*18210 / K 320*

Teile- / Serien-Nf.  
Part No. / Serial No.

*20.10.2002 i. A. Maurer*

Prüfdatum / Prüfer  
Test data / Tested by

dass die Lieferung der Auftragsbestätigung  
(die) Bauteil(e) aufgrund der Prüfergebnisse  
freigegeben ist (sind).

The delivery is in accordance with the order  
the component(s) has (have) been released  
on the basis of the test results.

**Prized quality**

The quality of training concepts, the quality of the product and the company processes are integral parts of innovation. As the leading supplier of automation technology worldwide we offer you guaranteed quality.

However, the best training concepts are of little value if the products do not meet the demands of everyday practice.

Here too, we guarantee 100% quality:

- Festo Didactic's training systems and components meet the requirements of all the relevant standards and guidelines such as DIN/ISO and VDE.
- Only industrial components are employed.
- Festo Didactic is DIN EN ISO 9001 quality certified.
- As a solution partner to Siemens Automation, we offer customised, forward-looking solutions using products and systems from Siemens Automation and Drives. Qualified product and system expertise combined with superior solution and sector competence provide the basis for this.
- As the first choice partner to "Siemens Automation Cooperates with Education" (SCE), we offer customised solutions for research, development and training centres.
- Our customers' opinions are important to us. As such, we regularly carry out customer surveys.
- Together with other market-leading companies from various sectors, we are a member of Mitsubishi Electric's "e-F@ctory Alliance". This means that you can profit from the best possible solutions in terms of costs, productivity and integration.



The training hardware and learning media comply with the latest general requirements and findings.

The awards speak for themselves:

- **Equipment set TP 1011 Fundamentals of electrical engineering/electronics**  
iF product design award 2011  
Focus design award in Silver 2011
- **MecLab®**  
Worlddidac Award 2008
- **Robotino®**  
reddot Design Award 2006 and 2014  
iF product design award 2014  
Worlddidac Award 2006
- **Learnline**  
Winner of international design prizes:  
iF product design award 2006  
Focus design award in Silver 2005



## Service with Value added



**We support you and deliver advice and assistance.**

Whether you need information, are looking for advice before making an investment or have questions about everyday use of the products: we are always only a phone call away – and have been for more than 40 years now.



**Low-cost industry quality**

Brand-name quality at low prices. We always select products from industry and we do not use gadgets that are not up to the rigours of use in training.

**Modular and future-proof**

We build learning systems that are 100% modular. This means you can always expand them flexibly and make your investments future-proof without reaching a dead end.

**Quality with no ifs or buts**

All products (except consumables) come with a 2-year warranty. And if a part should cease to function years down the line, you can obtain spare parts from us quickly and easily, or else you can purchase a new part at a cut price using our exchange service.

**Didactic and design**

Ergonomics, didactic concepts and design go hand-in-hand at Festo Didactic. Numerous international awards underline our commitment.

**Teacher training, info events and special seminars for trainers**

You can take part in free teacher training and info events. Alternatively, you can visit us at numerous trade shows around the world. What is more, there is a large number of fee-paying special seminars available for trainers.

**Free software, demos and sample extracts**

For example, EasyVeep is a new graphic 2D process simulation software that is available for download free of charge. It comes with numerous attractive examples for PLC training. You can sample many software products and all books free of charge on the Internet using test and demo versions.

**Online configurators**

Make the selection and ordering process simple. For example, you can configure laboratory furniture and EduTrainer® easily and conveniently on the Internet.

**Free of charge online dictionary**

Only Festo Didactic offers an extensive Dictionary of Automation in 6 languages, free of charge on the Internet.

**Free symbol library according to DIN ISO 1219**

More teaching aids are available to be downloaded from our website.

**Your partner, worldwide**

We speak your language! And we're just around the corner – in more than 100 countries around the world. Advice and orders can be phoned, faxed, e-mailed or done via the Internet. Alternatively, give your technical consultant a call for a qualified needs analysis conducted onsite.

## Training and Consulting



Success with the right combination of methods



**Consistently adding value**

Festo Training and Consulting: 40 years' experience in training and 20 years' experience in process optimisation.

Various projects in over 53 countries worldwide show that we can successfully design change processes together with our customers.

Seminars, workshops and corporate strategic planning simulations, public or in-house seminars. Gathering hands-on experience and learning using real products and training factories is always top priority. Individual learning success can be measured and thus the ability to quickly apply the knowledge gained to day-to-day work situations is a crucial indication of the quality of the training.

**Training**

Training and skills development programmes for technical staff and managers from industry.

More than 2,900 events are attended by more than 42,000 participants annually. Modular and high-quality course topics in more than 39 languages relate to the topics: people, technology and organisation.

Public or in-house training sessions with individually tailored content – hands-on learning with a focus on industry and fast transfer to industrial applications takes centre stage.

Certified skills development programmes for:

- Mechatronics engineers
- Production managers
- Maintenance managers

**Consulting**

Identifying and optimising value-added processes.

Together we trace the flow of information and products through your company from beginning to end, always with the aim of making it more efficient and to prevent waste. We use world-renown methods and tools which are also implemented at Festo. Together we define goals by which we can be measured.

Projects in the areas of:

- Production and logistics
- Management and teamwork
- Skills development
- Procurement and SCM
- Product development

You can find information, dates, locations and prices on the internet:  
[www.festo-didactic.com](http://www.festo-didactic.com)

# Media





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# Software

## Learning, controlling, simulating



### Importance of software in the learning process

Anyone who wants to design successful training processes and courses must make sure that everything fits together:

- The electronic Classroom Manager manages target groups, content and media. Interactive self-study programs replace textbooks.
- CIROS® or FluidSIM® simulations supplement the range of realistic training environments. The PC becomes a complete platform for virtual and yet practical training.
- STEP 7 classroom licenses ensure that every student can access the industrial controller.

Without software, contemporary training courses are almost impossible.



### Learn, teach and organise

Teachers and trainers design their training based on requirements and the available methods.

Multimedia training programs from Festo Didactic ensure professional confidence and can either be used to help explain topics during teaching or as self-study programs.

The Classroom Manager helps to organise target groups and create individual training courses.



### Control, operate, observe

Software applications are the visible face of automation for technical staff. Anyone who wants to get to grips with the technology must be able to confidently use the programming systems, operating and visualisation software, configuration tools and other packages. The transfer of knowledge acquired during the training must be quick. This is why market leading software solutions are a key element of any training system.



### Programming and simulation

A training environment for PLC or fluid engineering can meet very different requirements:

- Maximum practical relevance: Real controller and real process
- Low budget: real controller and virtual process
- Flexible range of control systems: virtual controller and real process

Simulation environments in 3D and software controllers are standard equipment in a modern training laboratory.



#### EasyPort: Bridge to added value

Anyone who wants to extend the range of exercises depends on using simulation environments. FluidSIM® or CIROS® are standard equipment in control technology.

For example, EasyPort connects the PLC with the simulated process on the PC. The 3D models in CIROS® extend the range of exercises by more than 4 times and provide brand new possibilities for differentiated training.



#### Multimedia training programmes: The key to independence

The automation technology learning system contains self-study programs for almost all basic topics. They

- support the design of differentiated training
- promote competent activity
- provide structured background knowledge
- ease the burden on the trainer

	Multimedia training programmes	Measurement and control	Control	Programming	Circuit design Planning	Process simulation	Process visualization
<b>Pneumatics</b>	Yes	FluidLab®-P FluidLab®-M	FluidSIM® FluidLab®-M	FluidLab®-M	FluidSIM® EPLAN	FluidSIM®	
<b>Hydraulics</b>	Yes	FluidLab®-H FluidLab®-M	FluidSIM® FluidLab®-M	FluidLab®-M	FluidSIM® EPLAN	FluidSIM®	
<b>Electrical engineering</b>	Yes		FluidSIM®		EPLAN	FluidSIM®	
<b>Automation technology PLC</b>	Yes		PLCSIM	STEP7 CODESYS®	EPLAN	CIROS® EasyVeep	WinPISA WinCC
<b>Mechatronics Factory automation</b>	Yes		CIROS®			CIROS®	
<b>Robotics Mobile robotics</b>			CIROS Robotino® View	CIROS® Robotino® View		CIROS® Robotino® SIM	
<b>Process automation Closed-loop control technology</b>	Yes	FluidLab®-PA			EPLAN		WinCC InTouch
<b>Metal technology CNC</b>	Yes		WinNC	WinNC	CAMConcept	Win3D-View	

# Multimedia training programmes

## Well-prepared knowledge



Festo Didactic training programmes are flexible; they offer tutors room to be creative and increase students' motivation.

All our training programmes have the following features:

- Excellent didactic and multimedia course topics
- Scope for self-study during classroom-based training
- Learning scenarios can be individually customised
- Varied programme functions, such as a glossary, search function, notes
- Can be used in conjunction with Classroom Manager
- Can be integrated into training concepts which use other media (Word, Excel, PDF, etc.)
- Participant guidance
- Monitoring of learning progress and certification

The training programmes are optionally available as follows:

- CD-ROM
- Licence for local networks (on request)
- Web-based training (WBT) for Classroom Manager
- For installation on one of your servers or in your Learning Management system
- For integration in open-source software (such as Moodle, Ilias, etc.)
- Alternative lease option available directly via the Internet using my|eCampus

Should you have any other wishes, we will be pleased to create an e-learning package specially tailored to your needs. We will gladly advise and guide you through each step, from the design phase through to the installation of the complete Learning Management system.

Overview of our programmes:

### Fluid engineering

- Pneumatics
- Electropneumatics
- Hydraulics
- Electrohydraulics

### Electrical engineering

- Electrical safety measures
- Electrical engineering 1
- Electrical engineering 2
- Electronics 1
- Electronics 2

### Automation technology

- Sensor technology 1
- Sensor technology 2
- Discover MPS® 200
- Actuators – DC motor
- Electric drives 1
- Electric drives 2
- Open- and closed-loop control
- GRAFCET
- PLC programming in accordance with IEC 61131
- LOGO! Training
- Fieldbus technology
- Machine vision
- Safety engineering
- Process automation

### Metalworking

- Turning
- Milling
- Drilling
- Materials science

### Technology and Environment

- The fascination of technology
- Renewable energies
- Environmental protection in the office

### Organisation and methods

- Project management
- Time management
- Internet search

### Lean Management/Lean Production

- Value stream analysis and mapping
- Poka Yoke
- 5S – Workstation organisation
- TPM – Total Productive Maintenance

### Management and teamwork

- Customer orientation
- Team performance
- Personnel management
- Compliance

### Training

- Safety at work
- General law on equality and discrimination (German: AGG)
- Basic principles of accounting

### Management systems

- Classroom Manager
- Content Builder
- Local Knowledge Manager
- Competence Manager
- Recruiting Manager
- Classroom Manager Enterprise

### System requirements for WBTs

- PC with Win 2000/XP/Vista/Windows 7
- Flash Player, version 8.0 or higher
- Sound card
- DVD drive
- Screen resolution: minimum 1024 x 768 pixels

### Languages

All of our WBTs are available in several languages. The language is selected when starting the WBT and can be changed directly on every page during the training. This gives you a multilingual dictionary in addition to our training programs.

If your language is not listed, we can provide an individual quotation.

### my|eCampus

A vast range of high-quality training programs available 24/7.

my|eCampus contains interesting training programs for automation technology and mechatronics. Whether school or university students, technicians or engineers – anyone with internet access can look into these topics around the clock and pick up further qualifications.

Try it for yourself. It is worthwhile – not just for engineers!

# Pneumatics



Everything on the subject of pneumatics. The program is divided into technical knowledge and course-work.

## Technical knowledge

This interactive self-taught program covers the basics of pneumatic control. Participants learn to find practical and theoretical solutions to the key tasks of a basic course on pneumatics, e.g. as part of a basic vocational training course.

## Course

In this course the theoretically acquired technical knowledge is reinforced. A wide range of exercise types makes the course interesting and successful: participants have to draw symbols and circuit diagrams, answer multiple-choice questions and set up and connect circuits in PC-based video clips.

From the contents:

- Physical basics (units, properties, laws)
- Energy supply (production, preparation and distribution of compressed air)
- Circuit diagram (circuit diagram, symbols)
- Drive components (applications, linear drives, rotational drives)
- Valves (designs, directional valves, stop valves, pressure control valves, flow control valves, valve combinations, logic elements)
- Signalling components (manual signalling, endpoint detection)
- Additional requirements

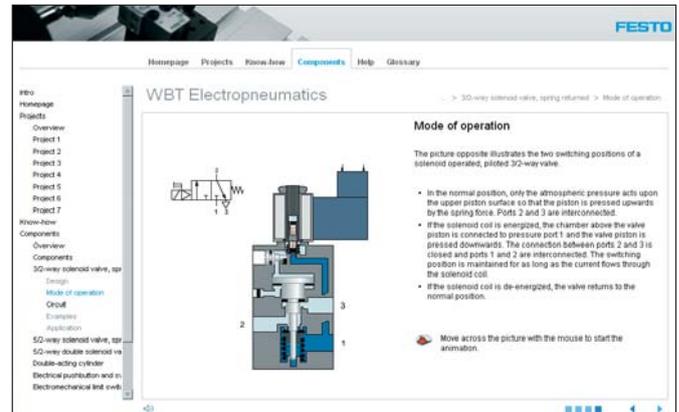
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# Electropneumatics



The Electropneumatics training program builds on the Pneumatics training program and reinforces material already learned from practical projects. Starting with concrete industrial applications, fundamental electropneumatic circuits are produced. With the help of numerous exercises, learnt material will be revised, applied and further developed by you. During an exercise, the programme reacts to each answer with varying feedback.

The trainee is supported by the basic knowledge module, which provides fundamental knowledge on electropneumatics in a structured, systematic manner. In the components module, the structure, function and application of typical electropneumatic components is described. Various supporting materials are available to complete the exercise such as PDF documents, a variety of downloads and a comprehensive glossary.

From the contents:

- Advantages and drawbacks of electropneumatics
- Safety in electropneumatic circuits
- Fundamentals of electrical engineering
- Pneumatic circuit diagram
- Electrical circuit diagram
- Basic logic functions
- Direct and indirect electrical control, time and pressure dependent process controls
- Signal storage in the power and in the control unit, latching circuit
- Documentation for a control unit
- Maintenance and repair of electropneumatic systems
- Solenoid actuated valves
- Double-acting cylinders
- Electrical buttons and switches
- Sensors
- Relays and contactors, timed relays
- Pressure switch
- Standardised circuit diagrams, electrical and pneumatic circuit diagrams

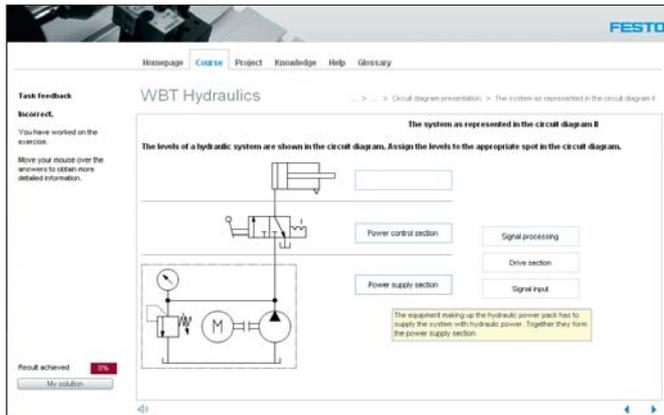
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Order no. **540925**

# Hydraulics



Everything on the subject of hydraulics. The program is divided into technical knowledge and coursework.

## Technical knowledge

This interactive self-taught program covers the basics of hydraulic control. Participants learn to find practical and theoretical solutions to the key exercises in a basic course on hydraulics, e.g. as part of a basic vocational training course.

## Course

In this course the theoretically acquired technical knowledge is reinforced. A wide range of exercise types makes the course interesting and successful: participants have to draw symbols and circuit diagrams, answer multiple-choice questions and set up and connect circuits in PC-based video clips.

From the contents:

- Physical basics (units, properties, laws)
- Hydraulic systems (principles of a hydraulic system)
- Drive units (components, pumps, containers, filters)
- Drives (single-acting cylinders, double-acting cylinders, hydraulic motors)
- Directional valves (design characteristics, 2/2 directional valves, 3/2 directional valves, 4/2 directional valves, 4/3 directional valves, special circuits)
- Stop 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)
- Additional requirements

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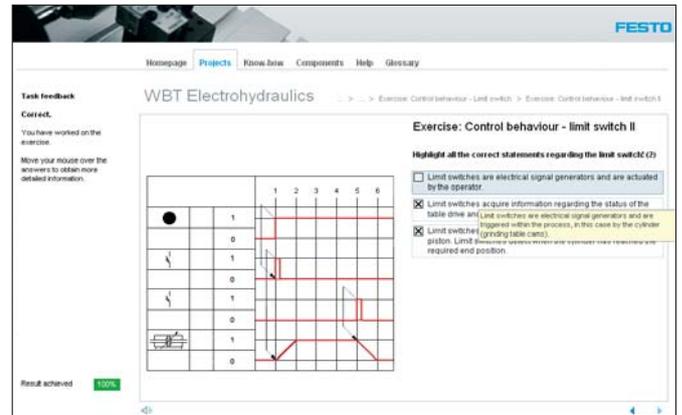
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Order no. **540919**

# Electrohydraulics



The Electrohydraulics training program builds on the Hydraulics training program and reinforces material already learnt from practical projects. Starting with concrete industrial applications, fundamental electrohydraulic circuits are produced. With the help of numerous exercises, learnt material will be revised, applied and further developed by you. During an exercise, the programme reacts to each answer with varying feedback.

The trainee is supported by the basic knowledge module, which provides fundamental knowledge on electrohydraulics in a structured, systematic manner. In the components module, the structure, function and application of typical electrohydraulic components is described. Various supporting materials are available to complete the exercise such as PDF documents, a variety of downloads and a comprehensive glossary.

From the contents:

- Advantages and drawbacks of electrohydraulics
- Safety in electrohydraulic circuits
- Fundamentals of electrical engineering
- Hydraulic circuit diagram
- Electrical circuit diagram
- Basic logic functions
- Direct and indirect electrical control, time and path-dependent process controls
- Signal storage in the power and in the control unit, latching circuit
- Documentation for a control unit
- Maintenance and repair of electrohydraulic systems
- Solenoid actuated valves: spring return and pulse valves
- Double-acting cylinders
- Electrical buttons and switches
- Sensors
- Relays and contactors, timed relays
- Standardised circuit diagrams, electrical and hydraulic circuit diagrams
- Documentation of electrohydraulic controllers
- Simulation of a hydraulic and electrical circuit diagram

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Our authoring tool:  
**Content Builder**  
Devise and design your own training media

# 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 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

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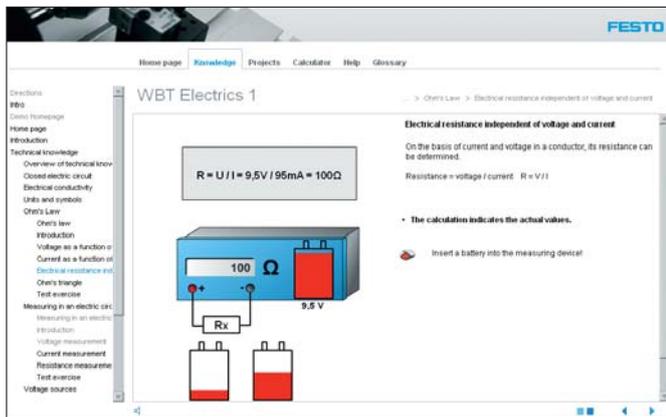
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# Electrical engineering 1



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 practically oriented and authentically structured. Case studies from practice provide a concise illustration of the matters 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.

Progress monitoring exercises are scheduled after a maximum of five pages of learning. The aim of this is to have trainees repeat, apply and develop what they have learned themselves. Exercises are incorporated during teaching, at the end of each learning step and within the case studies. During an exercise, the program responds to each of the trainee's answers with the appropriate feedback.

Various tools are built-in to the training program, such as Excel worksheets, an integrated calculator, PDF files and various downloads. The training programs include an extensive glossary and a full text search facility.

- Content extracts:
- 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
  - Battery-powered screwdriver
  - Measuring range extension
  - Temperature controlled heating
  - Level detection

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# 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 practically oriented and authentically structured. Case studies from practice provide a concise illustration of the matters covered. All training content is taught by means of audio clips. Additionally, the narrative text can be viewed on the sitemap.

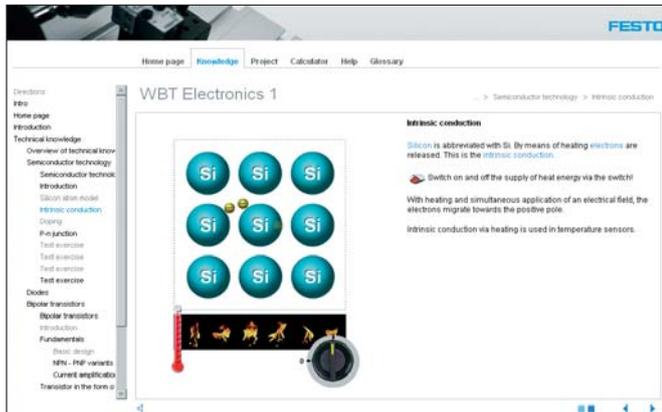
Various tools are built into the training program, such as Excel worksheets, an integrated calculator, PDF files and various downloads. The training programs include an extensive glossary and a full text search facility.

- Content extracts:
- 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
  - Light switch-off delay
  - Electrical behaviour of a grinder
  - Power generation and transmission

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Our authoring tool:  
**Content Builder**  
 Devise and design your own training media

# 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 practically oriented and authentically structured. Case studies from practice provide a concise illustration of the matters 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.

Progress monitoring exercises are scheduled after a maximum of five pages of learning. The aim of this is to have trainees repeat, apply and develop what they have learned themselves. Exercises are incorporated during teaching, at the end of each learning step and within the case studies. During an exercise, the program responds to each of the trainee's answers with the appropriate feedback.

Various tools are built into the training program, such as Excel worksheets, an integrated calculator, PDF files and various downloads. The training programs include an extensive glossary and a full text search facility.

Content extracts:

- Semiconductor technology
- Diodes
- Bipolar transistors
- Field-effect transistors
- Regulated power supply
- Audio amplifier
- Audio amplifier with sound control

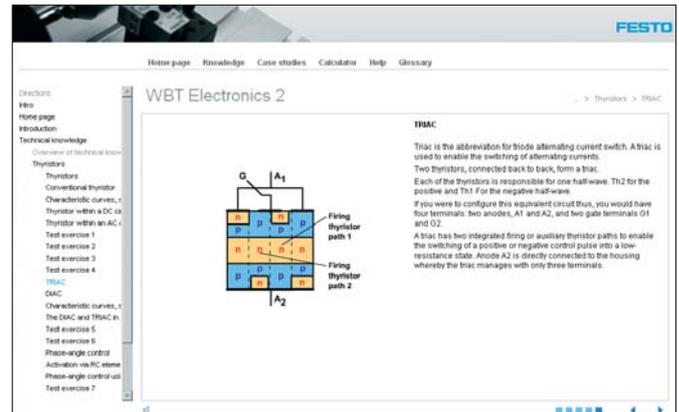
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Order no. **549631**

# 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 practically oriented and authentically structured. Real case studies provide a concise illustration of the matters covered. All training content is taught using audio clips. Additionally, the narrative text can be viewed on the sitemap.

Various tools are built into the training program, such as Excel worksheets, an integrated calculator, PDF files and various downloads. The training programs include an extensive glossary and a full text search facility.

Content extracts:

- 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
- Thyristor-controlled drilling machine
- Brightness control with triac
- Adjusting the speed of an electric screwdriver

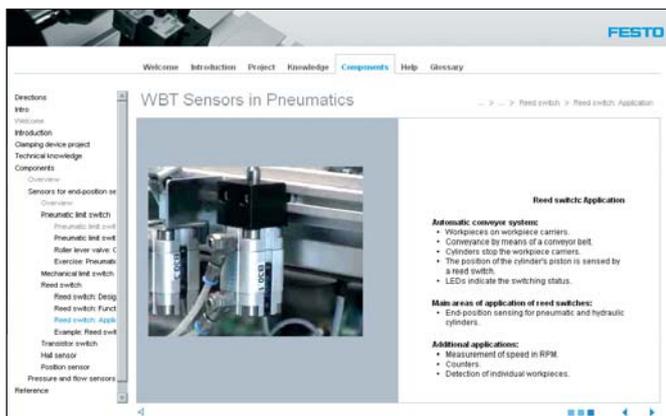
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# Sensor technology 1



## 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.

## Content extracts:

- 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

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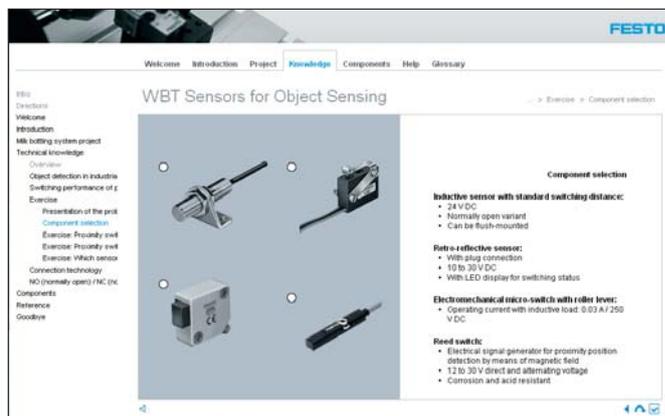
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# Sensor technology 2



## 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.

## Content extracts:

- 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

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## Discover MPS® 200



A multimedia introduction makes it simple to work with the MPS® 200 modular production systems by Festo Didactic. First, we introduce you to the principle behind the complete system, and then we show you how to operate and commission it. You then become familiar with the individual “Distribute” and “Sort” stations in the process and learn how the modules function. You can apply your new knowledge of MPS® 200 in a short test, then relax and play a game.

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## 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 contents:

- The function of actuators in mechatronic systems
- Electric motors
- DC motor
- Torque and current
- Behaviour of DC motors
- Induced voltage and speed control
- Characteristic torque/speed curve
- Working with data sheets
- Determining the transmission ratio

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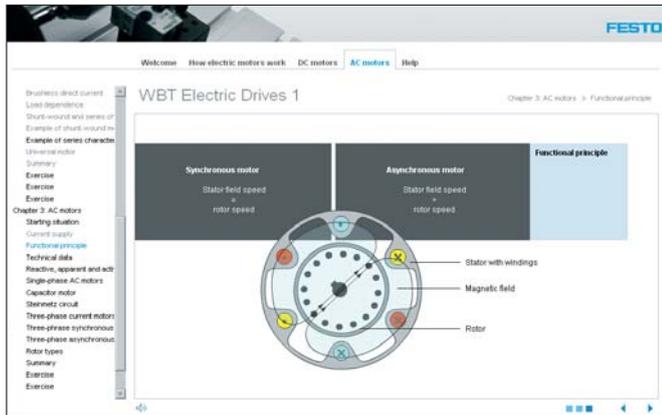
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# Electric drives 1

# Electric drives 2



The “Electric drives 1” interactive multimedia training program provides an interesting 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 contents:

- Basic principles of electric drives
- Getting to know 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)

- Getting to know 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)
- Getting to know 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 special cases (stepper motors)
- Summary and review exercises

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The learning program “Electric drives 2” further explores the material covered in “Electric drives 1” and also includes new topic areas.

This learning 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 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
- Minimising losses
- Reliability
- Energy efficiency measures
- Environmental aspects
- Merits of electric motors

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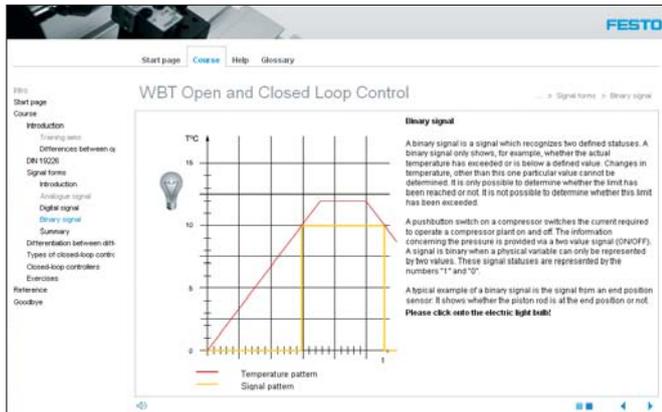
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# Open- and closed-loop control



The 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 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)

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# GRAF CET



GRAF CET – 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 quicker. 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-related examples.

From the content:

- 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

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# PLC programming in accordance with IEC 61131



Programmable logic controllers play a central role in automation. These devices are used to control machines and systems.

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 conformance with standards.

This training program allows users to get to grips with function charts, ladder diagrams, instruction lists, sequential function charts and structured texts in five programming languages. Through the use of various practice-related examples, the programming languages are presented step by step.

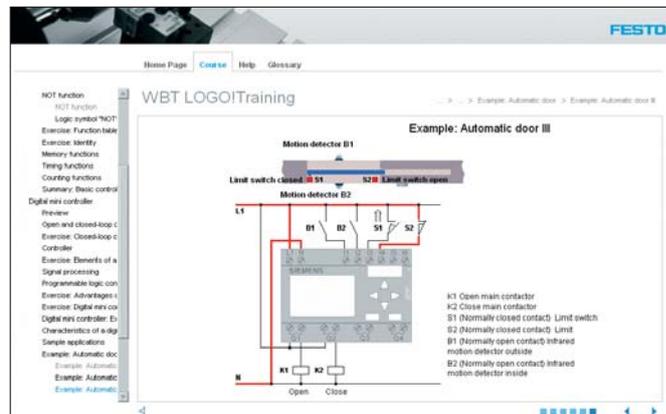
- Contents:
- Programmable logic controllers
  - Project organisation
  - Programming languages in accordance with IEC 61131
  - Link-orientated programming languages
  - Sequential function chart
  - Structured text
  - Sequence programming project

The training program provides beginners with an ideal introduction to IEC-compliant programming.

In addition to trainees, pupils and students, it also appeals to skilled workers, technicians and engineers who have previously only programmed in IL, LDR or FCH. The higher, IEC-compliant languages provide a range of benefits to be discovered and used.

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# LOGO! Training



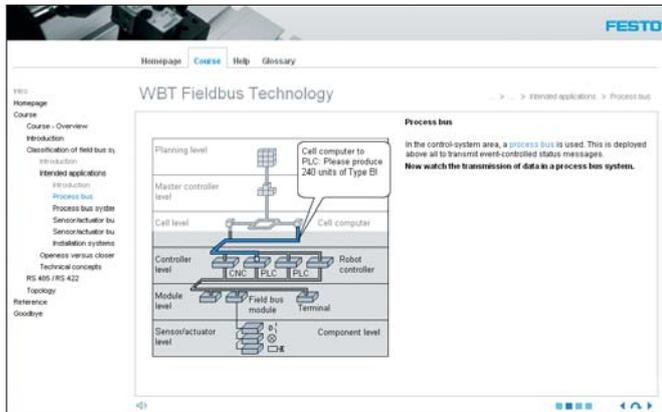
This training program provides an introduction to logic functions. First of all, AND & OR functions and their processing are shown in function tables. Other basic control functions such as memory, timer and counter functions round off the contents. The second part starts by covering the basics of open-and closed-loop control circuits and describes the elements of a controller. It then takes a detailed look at minicontrollers with their features and areas of application.

- From the 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 programme processing
  - Areas of application
  - Programming languages

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# Fieldbus technology



The multimedia and interactive training program will teach you the basics of Fieldbus technology. It is suitable for beginners who would like to get 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 lexicon.

From the 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)

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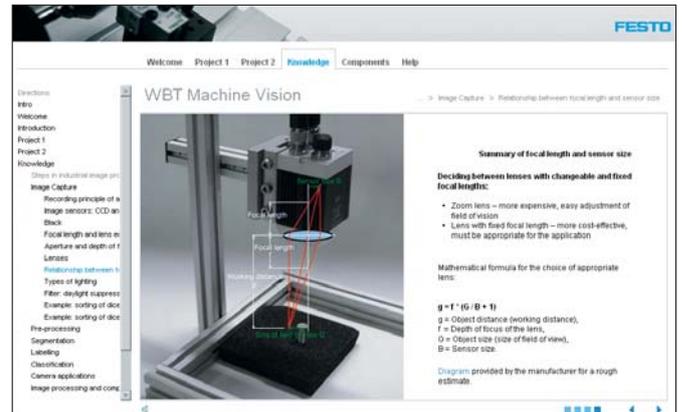
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# Machine Vision



Machine Vision – the use of camera systems in production – is a relatively young, but swiftly growing area in automation technology. This web-based training unit deals with industrial image processing, from the creation of images up to the evaluation of the information in the picture. Working from actual practical industrial applications, students can follow all the steps in the image processing project in a practical manner. The basic knowledge required for this is clearly explained in the individual chapters of the technical knowledge module. In the components module, cameras and lighting systems are presented using examples.

From the contents:

- How does a machine see?
- Steps in industrial image processing
- Image sensors: CCD and CMOS
- Focal length and lens formula
- Aperture and depth of focus
- Types of illumination: objects subject to backlighting and incident light
- Filters to improve the image
- Point operators, local and global
- Average and median filters
- Sobel operators and Laplace filters
- Process for image segmentation
- Global and local threshold processes
- Tools to calculate characteristics
- The classification of parts and characteristic curves
- Image processing and computing times
- Intelligent compact vision systems
- Lighting systems
- Sample applications of industrial vision systems

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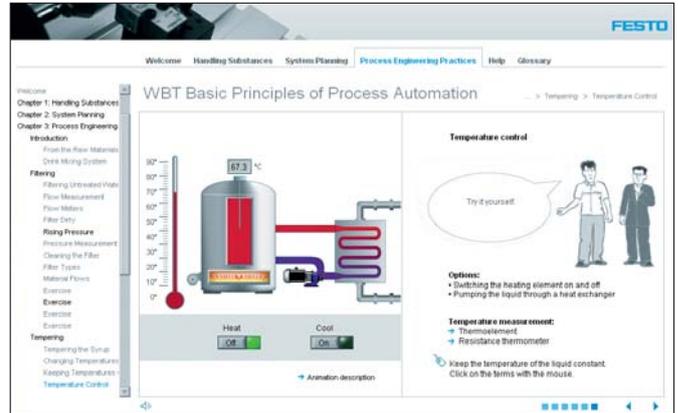
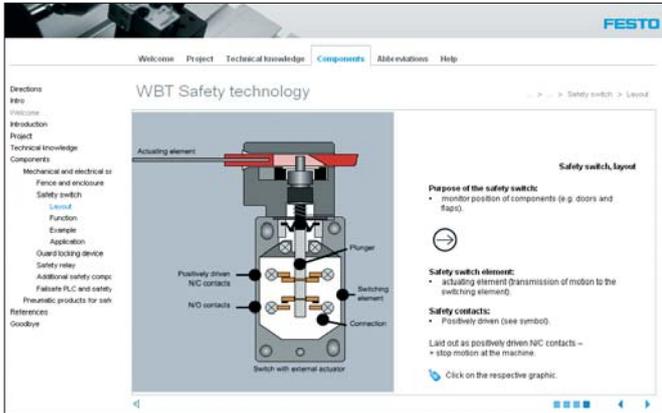
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# Safety engineering

# Process automation



This training programme 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 programme 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 programme explains concepts such as probability of failure (POF), diagnostic coverage (DC), common cause failure (CCF), redundancy and diversity. There is also a detailed explanation of all the components for safety equipment.

From the 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

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## Basic principles of process automation

This training program deals with the broad spectrum of technical process automation in a compact way. The characteristics and special features of process automation are conveyed in a simple manner via images from real situations, graphical representations of physical-technical processes and animated processes which you yourself can manage and control.

From the contents:

The three chapters “Handling substances”, “System planning” and “Process engineering processes in practice”, give you a step-by-step guide to a complete on screen system. The content of these chapters is reflected in the MPS® PA stations, which you will use during the practical part of your training.

## - Handling substances

Product manufacture is usually subject to defined physical and chemical characteristics. The student’s awareness should be heightened so that he/she can accurately assess production conditions and deal with them correctly.

## - System planning

This guides the student around a planning office, providing an insight into the planning and development of a system. The student can examine all the fundamental activities of the planning phase, from the basic principles of project management to drawing a circuit diagram until the system can finally be built.

## - Process engineering processes in practice

The vast number of process engineering processes can be reduced to four typical ones: filtration, tempering, mixing and filling. Design and function are analysed using the four MPS® PA stations and the modular products from Festo Didactic and answers given to any questions that may arise when studying process engineering processes.

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# Basic principles of metalworking



Whether in machine manufacturing, toolmaking or vehicle production, metalworking is an essential element in trades and industry. In the series “Basic principles of metalworking”, we look at 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 rotary main 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.

### Content topics:

- How does a lathe work?
- Selecting the tool
- Clamping the workpieces
- Turning

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## Milling

Milling is a machining method for processing metal, wood and plastics. In the milling process, flat surfaces and contours can be produced using a milling tool. 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.

### Content topics:

- How does a milling machine work?
- Selecting the tool
- Clamping the workpieces
- Milling

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## 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 metalworking” series, you will acquire basic knowledge of drilling.

### Content topics:

- What is drilling?
- Selecting the tool
- Drilling
- Counterboring
- Reaming

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## 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 turning.

### Content topics:

- An overview of materials
- Material properties
- Types of materials
- Testing of materials

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# Technology and Environment



## The fascination of technology

This exciting journey through the history of technology shows how inventions have changed the world. New forms of work have been created: from the hunter to the engineer. „The fascination of technology“ is an interactive journey through the world of automation. The program contains many different multimedia components to help you on your journey. Experience the excitement of discovery and learning – this is pure education!

The programme consists of 4 modules:

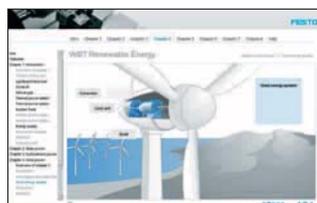
- Technology and automation
- The history of automation technology
- Fundamentals of automation technology
- Technology and ...

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## Renewable energies

Day after day, we consume enormous amounts of energy in the form of electrical power, for example to operate industrial machines and public transport systems such as the underground and suburban railways, as well as lighting and other household appliances.

In addition to conventional forms of energy, renewable energy is available to us as well, and will become more and more significant for our supply of energy in the future.

Basically, there are three types of energy available to us for generating electrical power: fossil fuels, nuclear fuels and renewable energy.

This training program provides you with an overview of the different sources of energy. We would like to offer you a detailed introduction to renewable energy sources, and show you how we can make use of them.

From the contents:

- Solar energy
- Water power
- Wind power
- Geothermal energy
- Bio-energy
- Energy storage
- Perspectives

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## Environmental protection in the office

Environmental protection has become an essential part of modern working life. You can actively reduce your impact on the environment and the climate in your everyday work.

Our web-based training „Environmental Protection in the Office“ provides you and your employees with concrete methods to make your daily working routine more environmentally friendly. Not only will this allow you to save on energy, water and office supplies but it will also help to reduce the costs of these resources.

From the contents:

- The carbon-neutral office
- Saving electricity
- Paper as a raw material
- Environmentally friendly office supplies
- Sustainable waste management
- Saving and protecting water

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# Organisation and work techniques



## Project management

Successfully manage complex technical projects and systems.

Investing around 60 minutes of your time in training pays for itself many times over, through increased professionalism and confidence when managing projects. The three modules contain essential information about basic principles and provide you with lots of practical hints and tips.

Content extracts:

### Basic principles

- What is a project?
- Project planning
- Project organisation
- Project documentation

### Project in practice

- Analysis
- Structuring
- Time intervals and dates
- Resources
- Organisation
- Documentation

### Means of control

- 4-room apartment method
- S.M.A.R.T.
- Project structure plan
- Work packages and milestones
- Network planning
- Successive planning
- Time and expenditure planning
- Adherence to deadlines and capacity planning

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## Time management

Optimise the way you manage your most valuable asset. Create new freedom, thus generating more energy for new things.

In this training program you have the chance to achieve an extremely high return. The time commitment is around 60 minutes; the time you save could be many times more. In two modules, you will learn the basics of time management and how to apply it to your everyday work.

Content extracts:

### Basics

- The time phenomenon
- Goal-oriented working
- Time robbers
- Biorhythms
- Day planning
- Limits of time management

### Application to everyday practice

- Goals and tasks
- Definition as per S.M.A.R.T.
- Setting priorities
- Pareto principle
- ABCO analysis
- Workplace organisation
- ALPEN method

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## Internet search

Give yourself an advantage by learning quick and easy ways to search for relevant information on the World Wide Web.

In two modules, you will learn to utilise the Internet effectively as an information resource and to use search methods and tools.

Content extracts:

### The Internet as an information resource

- The right preparation
- The difference between catalogues and search engines
- Search terms and logic operations
- Using filters

### Tools and methods

- Search processes
- Goal description
- Consolidation circle
- Relevance of search results
- Verification of search results
- Making content available

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# 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 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

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## 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.

Content topics:

- 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

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Order no. **565019**



## 5S – Workstation organisation

The objective of the 5S training programme is to become familiar with methods to create exemplary, well-organised workstations (both in industrial and administrative areas), where work can be carried out without searching unnecessarily, without long transport distances and without 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.

Content topics:

- General basic principles
- The 5S model
- The seven types of waste
- Visualisation in 5S
- The 5S audit and its application
- 5S in production
- 5S in administration
- 5S workshop procedure

E.g. single licence with CD-ROM/DVD

Online de/en/es/fr/zh

Order no. **565020**

Network de/en/es/fr/zh

Order no. **565021**



## TPM – Total Productive Maintenance

It is always better to act than to react. Bearing this in mind, many businesses strive to stabilise the performance of their plants and to introduce preventative 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.

The learning program imparts fundamental knowledge about TPM. Here you will find out what TPM is and how you can implement this model in practice.

E.g. single licence with CD-ROM/DVD

Online de/en/es/fr

Order no. **576320**

Network de/en/es/fr

Order no. **576321**

# Cooperation and management



## Customer orientation

The subject of customer orientation is playing an increasingly important role. The success of a company also depends on how strongly it focuses on the needs of its customers.

This training programme offers an introduction to the complex subject of customer orientation. With the help of many practical examples, users learn how to optimally prepare for a customer meeting, how to successfully deal with customers and how to develop long-term business relationships.

### Content topics:

- How to correctly prepare for a customer meeting
- How to proceed during a customer meeting
- Customer expectations
- Questioning techniques, paraphrasing
- How to correctly communicate one's own services
- How to keep the customer in mind during discussions
- Recognising purchasing signals
- Needs analysis
- Relationship management

E.g. single licence with CD-ROM/DVD

Online de/en/zh

Order no. **567340**

Network de/en/zh

Order no. **567341**



## Team performance

Human resources and their integration into teams are becoming more and more important. What basic rules should be followed for team success? How do you motivate team members and use group dynamics for improving performance?

Based on specific examples, executive or project managers will learn the most important success factors for leading a team.

### Content topics:

- How does a team work?
- Phases of team development
- The role of the team leader
- Basic communication model
- Efficient meetings
- Motivation as a success factor
- Initiating motivation
- Empathy
- Group dynamics
- Conflict management
- Obstacles to project success
- Mediation
- Discussions about conflict and criticism

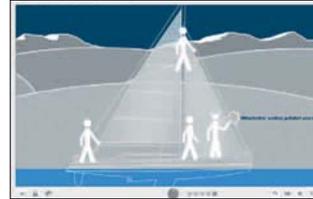
E.g. single licence with CD-ROM/DVD

Online de/en/zh

Order no. **567342**

Network de/en/zh

Order no. **567343**



## Personnel management

Competent management is not a talent, it can be learned. This training programme provides a good overview of how to delegate successfully by using management tools and how to create a positive working atmosphere with motivated employees using specific management communication techniques. Furthermore, users discover how to handle difficult situations and how to manage crises and conflicts in a positive way.

### Some sample topics:

- Optimal personnel management
- What does personnel management mean?
- Management behaviour and styles
- Social competence of executive managers
- Tools for personnel selection
- Employee development
- Agreeing on objectives
- Competence management

E.g. single licence with CD-ROM/DVD

Online de/en/zh

Order no. **567344**

Network de/en/zh

Order no. **567345**



## Compliance

Companies require rules and guidelines for in-house processes and for a uniform external presence. The term "compliance" has established itself for measures which promote regulated behaviour within a company. The employees of a company represent its external interface, and should therefore be able to follow rules when dealing with customers, partners and the authorities.

The WBT provides an overview of legal specifications and important principles of conduct which can serve as guidelines both for in-house and for externally-orientated actions.

The theoretical content of the WBTs is explained and elaborated based on many practical examples.

### Training content includes:

- What does compliance mean?
- Ethics in daily business
- Overview of important laws and directives
- Dealing with business partners
- Handling confidential information and data
- Professional behaviour in the workplace
- Safe handling of computers and dealing with new media

E.g. single licence with CD-ROM/DVD

Online de

Order no. **576324**

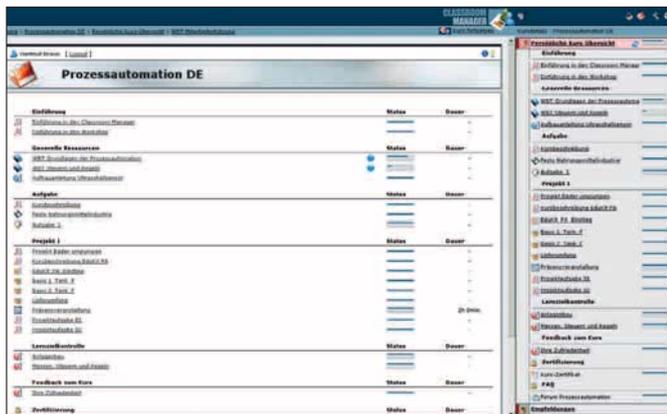
Network de

Order no. **576325**

Our authoring tool:  
**Content Builder**  
Devise and design  
your own training media

# Classroom Manager

## Learning management system



**Simple, professional, affordable:  
The learning management system  
Classroom Manager**

- Teaching and learning are dependent on time and location
- Better adaptation to individual learning patterns
- Visualised contents guarantee more attention
- Central library for digital training media
- Simple navigation through teaching and training media

The Classroom Manager is the quick and easy way to create, manage and supervise training sessions and courses. It enables you to combine presence-based courses, e-learning modules and many other training modules to make complete training units.

All the digital training media are compiled in a central library. Direct access to training media greatly reduces course preparation time.

The participants are provided with the right material for each session. You can create new tests, questionnaires or other training media whenever you need for participants completing courses or training sessions.

The Classroom Manager defines course structures and sets time frames, dates for attendance, training aids, access requirements and certification options. Participants and potential applicants can access this information as required.

Has everyone done their homework? The Classroom Manager provides a clear indication of participants' success in training. The training status monitoring system means you always have an overview of course attendance and the progress of the individual participants.

Access rights can be defined to allow colleagues to use the library and take a look at the available courses.

The Classroom Manager also allows students to keep an eye on their courses: the qualifications on offer are displayed clearly, and registering is quick and easy.

Ordering information:

**Classroom Manager (CRM) with up to 1000 users registered by name at 100 workstations at the same time** CD ROM with installation instructions, in de/en/fr/es/sv/el/zh.

Note:  
The order no. is configurable.

CRM 50 users at 5 workstations	Order no. <b>8034067</b>
CRM 100 users at 10 workstations	Order no. <b>8034067</b>
CRM 200 users at 20 workstations	Order no. <b>8034067</b>
CRM 500 users at 50 workstations	Order no. <b>8034067</b>
CRM 1000 users at 100 workstations	Order no. <b>8034067</b>

**Program improvements (SPV)**

The program improvements contains comprehensive hotline support for your administrators. It runs for 36 months and must be essential ordered with the classroom manager 100/10 or higher.

Note:  
The order no. is configurable.

SPV 50 users at 5 workstations	Order no. <b>8028155</b>
SPV 100 users at 10 workstations	Order no. <b>8028155</b>
SPV 200 users at 20 workstations	Order no. <b>8028155</b>
SPV 500 users at 50 workstations	Order no. <b>8028155</b>
SPV 1000 users at 100 workstations	Order no. <b>8028155</b>

**One-day installation support and training-day**

This offer contains the following services: One-day installation support, briefing and training on site. The one-day installation support and training-day must be essential ordered with the classroom manager 100/10 or higher.

Training in Germany	Order no. <b>8028154</b>
Training outside Germany	Order no. On request

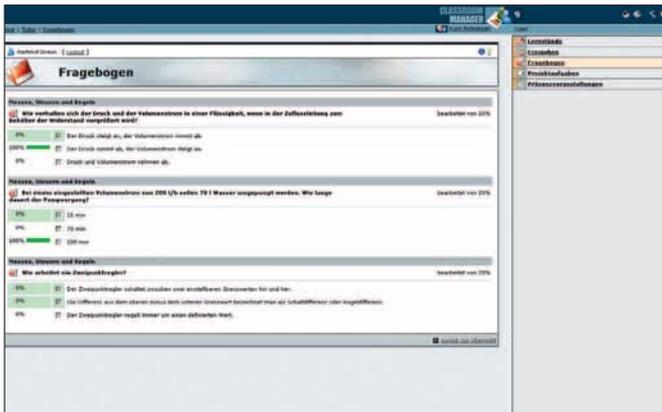
**Classroom Manager with campus/enterprise licence**

Campus/Enterprise licence	Order no. <b>Campus</b>
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**ASP solution**

The software is installed on a server run by us. Access via Internet connection.

ASP solution	Order no. <b>ASP</b>
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We've got great offers for ordering all the training programs with the Classroom Manager – take a look at the table.

Please note:

- WBTs that have already been installed from CD-ROM cannot be integrated into the Classroom Manager after installation. To do this, you will require a new version.
- The training programs are not included in scope of delivery for the Classroom Manager. Please order separately.

For details of the WBTs and the available languages, please see the product description or the website.

#### System requirements

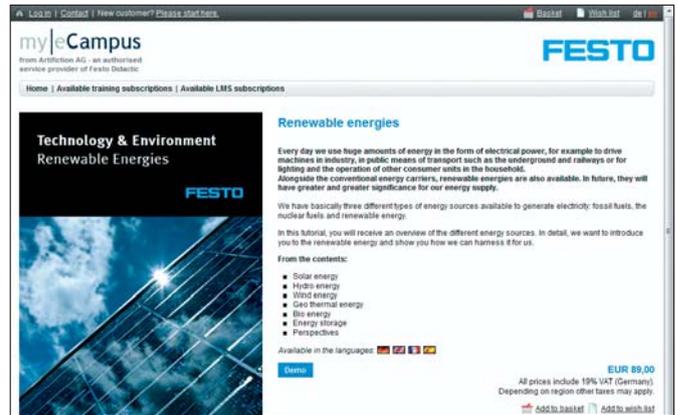
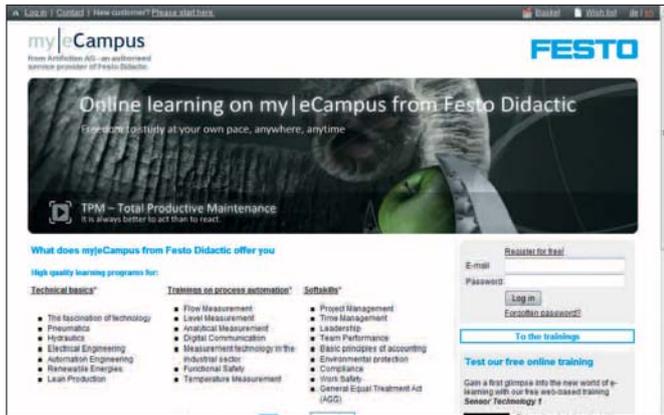
- Windows operating system Windows 2000 server (Web Edition) or higher
- Flash Player version 8.0 or higher
- Administrator access is essential for installation
- In addition to Classroom Manager, a number of free open-source components must be installed (Apache 2.x/MySQL 4.x or 5.x/PHP 4.x/Zend Optimizer). These are supplied in the installation bundle.
- For standard installation, the required ports are Port 80 (Apache) and 3306 (MySQL)
- The hardware should be an Intel/AMD x86 or x86-64 platform. No minimum requirements for CPU, memory or hard disk

Available training programmes	Order no. configurable
<b>Fluid engineering</b>	
Pneumatics	8038111
Hydraulics	8038112
Electropneumatics	8038113
Electrohydraulics	8038114
<b>Electrical engineering</b>	
Electrical safety measures	8038120
Electrical engineering 1	8038116
Electrical engineering 2	8038117
Electronics 1	8038118
Electronics 2	8038119
<b>Automation technology</b>	
Sensor technology 1	8038121
Sensor technology 2	8038122
Discover MPS® 200	8038123
Actuators – DC motor	8038124
Electric drives 1	8038125
Electric drives 2	8038126
Open- and closed-loop control	8038127
GRAFSET	8038128
PLC programming in accordance with IEC 61131	8038129
LOGO! Training	8038130
Fieldbus technology	8038131
Machine vision	8038132
Safety engineering	8038133
Process automation	8038134
<b>Metalworking</b>	
Turning	8038135
Milling	8038136
Drilling	8038137
Materials science	8038138
<b>Technology and Environment</b>	
The fascination of technology	8038139
Renewable energies	8038140
Environmental protection in the office	8038141
<b>Organisation and methods</b>	
Project management	8038142
Time management	8038143
Internet search	8038144
<b>Lean Management/Lean Production</b>	
Value stream analysis and mapping	8038145
Poka Yoke	8038146
5S – Workstation organisation	8038147
TPM – Total Productive Maintenance	8038148
<b>Management and teamwork</b>	
Customer orientation	8038149
Team Performance	8038150
Personnel management	8038151
Compliance	8038152
<b>Training</b>	
Safety at work	8038153
General law on equality and discrimination	8038154
Basic principles of accounting	8038155



# my|eCampus

## Learning on the Internet around the clock



### Learn online on my|eCampus – the new educational portal for engineers and technology enthusiasts.

my|eCampus offers interesting training programs in automation technology and mechatronics. Whether school or university students, technicians or engineers – anyone with internet access can look into these topics around the clock and pick up further qualifications.

Training programs on the following fundamental topics are available in German, English, French and Spanish:

- Fluid engineering
- Manufacturing automation
- process automation
- Electrical engineering
- Lean management
- Technology and the environment

No, or little prior technical knowledge is required to complete these classes.

Online learning via my|eCampus offers the following benefits:

- Excellent didactic and multimedia course topics
- Experts ensure quality content
- Freedom to learn anywhere and anytime at your own pace
- Saves travel time and down-time
- No need to install software
- No internal IT administration
- Versatile integrative and interactive program functions
- Educational progress is displayed

### Course subscription

All training programs are offered as subscriptions, i.e. you choose which training program you require for your qualification. The courses take at least six months. The annual subscription even gives you unlimited online access to all up-to-date course classes for technical training.

The courses can be booked both for individual users and for multiple users with multiple licenses.

Simple registration gives access to all training programs available on my|eCampus.

### The LMS subscription

With a Learning Management System (LMS) subscription, courses can be provided for a group of users. In addition to the course packages available in my|eCampus, subscribers can add their own documents and content to courses.

The administrator manages the students and tracks their progress. Various course packages on different topics are available.

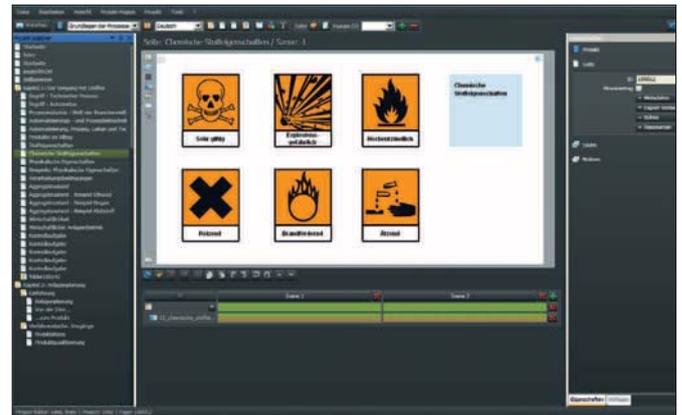
In the configurator, which helps you make your selection, you can define courses, the number of students and the duration of the system – either 6 months or 12 months. In the first four weeks, you have a personal my|eCampus-coach to instruct you in the system and support and advise you.

Try it for yourself. It is worthwhile – not just for engineers!

This way to my|eCampus:  
<https://festo.my-e-campus.com/>

# Content Builder

## Devise and design your own training media



### Devise digital training media quickly and inexpensively.

Build up and consolidate knowledge: create whole training scenarios!

Easy creation of exercises and tests thanks to a wide choice of exercise types and ready-made interaction scenarios. PowerPoint import functionality allows rapid e-learning. Experience optimized workflow in the production of training media.

The authoring tool Content Builder allows the development of high-quality digital training media. From classic web-based training through to material for blended learning scenarios and rapid e-learning media, Content Builder has many possible uses.

Use Content Builder, for example, in training projects or in publicity work. No matter whether you are dealing with data, facts or arguments – with Content Builder you can communicate information in a structured and stylish way.

As regards design and form, you can make use of numerous attractive and functional templates. Add content yourself using drag & drop or save time by importing it from other digital media formats such as PowerPoint.

Create interaction! Integrated facilities for creating interaction scenarios mean additional motivation for students. Intelligent functions allow you to produce ready-to-use results without any need for programming knowledge.

Speak many languages! The language import and export function allows you to create multilingual training media in next to no time. Texts which need to be translated can be output easily - thanks to the automatic import function, translations can easily be inserted at the same places in written or audio form.

Ordering information:

### Content Builder Classic

Content Builder Classic allows the development of high-quality digital training media. It is possible to create both training content and interaction and test scenarios easily. German version.

### Content Builder Professional

Content Builder Professional is used to develop professional digital training media. The numerous functions which the system offers not only allow the development of complex training scenarios but also provide workflow support during the creation process. German version.

Content Builder Classic

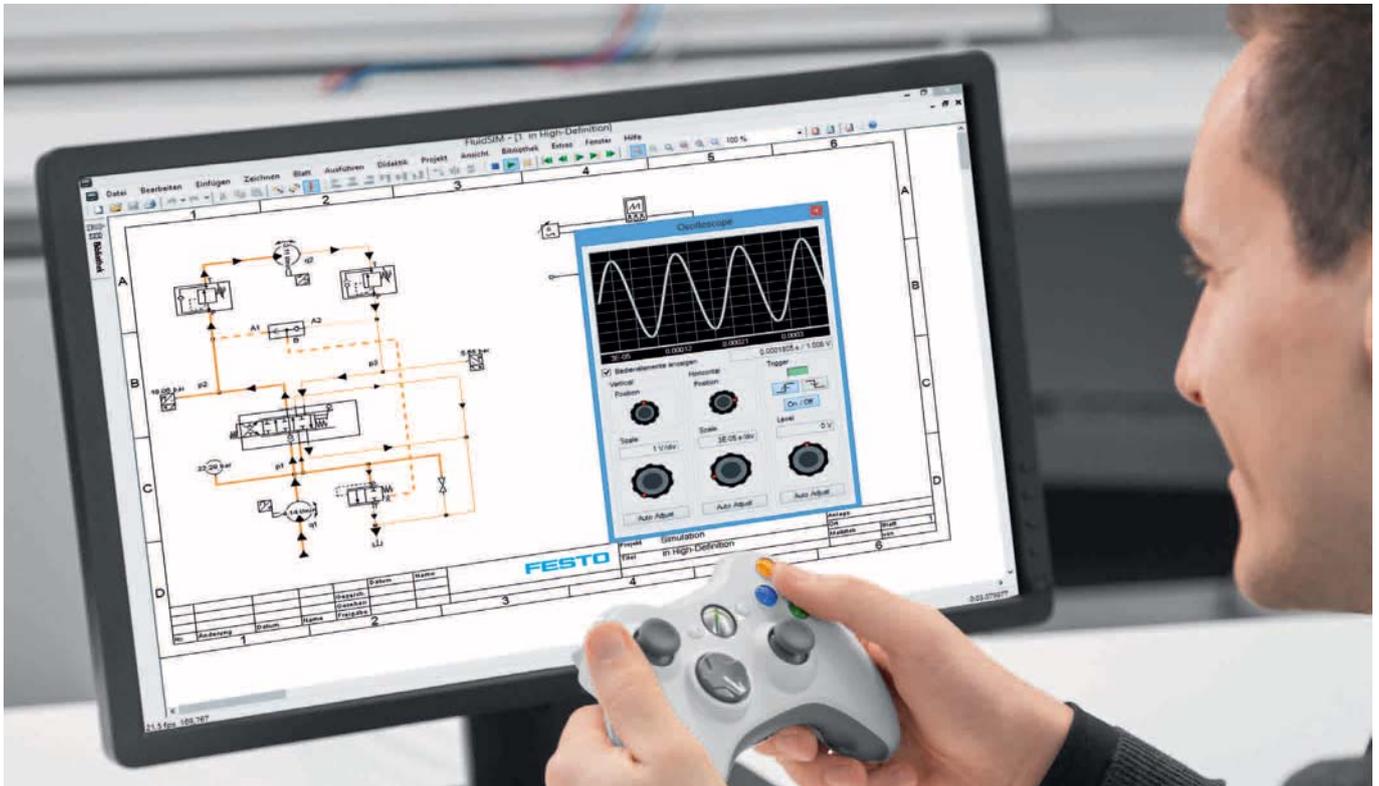
Order no. 576292

Content Builder Professional

Order no. 576293

# FluidSIM® 5

## Pneumatics/Hydraulics/Electrical engineering



For more than 20 years FluidSIM® has been the world's leading circuit diagram design and simulation program for pneumatics, hydraulics and now also for electrical engineering. Being able to freely design control systems is motivating, and promotes creativity and focus. Beyond that FluidSIM® provides teachers with a wealth of text, images and videos for multimedia-based lesson planning. Dive into the world of real-time simulations with your apprentices, specialists or students and celebrate successful learning at all levels!

### One tool for all needs

As a teacher and trainer, you are the expert who masters tasks that are needed to prepare lessons. That is why FluidSIM® 5 offers the expert mode. Your trainees should initially concentrate on the essentials. They can work and learn successfully in the standard mode, which has a reduced range of functions and offers advantages for the learning process.

### Testing in real time

Whether in a training environment or in an engineering office, the simulation of control systems and processes has been standard in industry for a long time; it helps to minimise losses due to crashes and ensures greater efficiency and improved quality. The parameters of all components are identical to those of the training packages from Festo Didactic and can be fully adapted to the characteristics of other components.

### The many aspects of GRAFCET

GRAFCET replaced the displacement-step diagram in training a long time ago. FluidSIM® 5 does even more with GRAFCET:

- Editing – for documentation conforming to standards
- Visualising – for maximum clarity
- Monitoring – coloured signals indicate where the process is running correctly or not at all
- Control – for manufacturer-neutral control of all fluid systems and electrical systems

### Speed made visible

The new simulation core of FluidSIM® 5 achieves simulation rates up to 10 kHz. The parameters of all actuators can be precisely adjusted. FluidSIM® 5 writes the simulation results in millisecond cycles and delivers them as a text file! The new simulated oscilloscopes make frequencies up to 100 kHz visible.

### Learning with fun and success

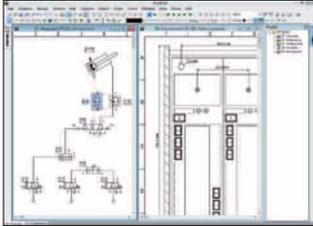
Theory is all well and good, but real practice provides motivation and promotes successful learning! In many situations, FluidSIM® 5 can be easily used as a controller for the real system: the EasyPort makes it possible – convenient, digital and analogue! New: with the joystick, FluidSIM® 5 is not only fun, but it now also allows several switches and valves to be operated simultaneously.

### Wide range – maximum convenience

Pneumatics, hydraulics, electrical engineering: the libraries are available separately or together in the same program. The user decides which of the libraries can be used in the program. All technologies interact optimally in a circuit diagram or project.

### Flexible installation and use

Online registration, network licence, usage at home: FluidSIM® 5 offers many licence models that facilitate economical learning scenarios in a school or in a company. A new learner administration function even allows you to provide and monitor licences for learning groups and to use the software at home.

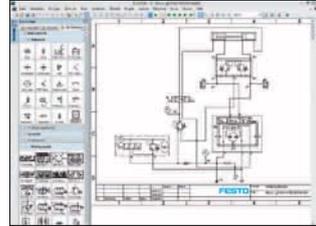


### Professional CAD according to standards

- Convenient drawing thanks to alignment lines and new snap functions
- Easy insertion of new symbols into existing connections
- Variable drawing frames
- Continuous scaling and rotation
- Dimensioning functions
- Intersection calculation of lines, rectangles and ellipses

### Completely according to standard

- All symbols to DIN ISO 1219 or DIN EN 81346-2
- Connection identification according to new equipment identifier
- GRAFCET according to the current standard

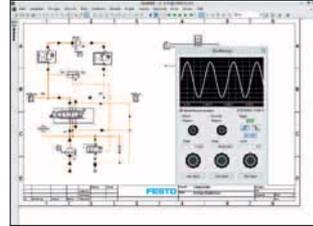


### Libraries for new technologies

- Libraries for the pneumatics and hydraulics training packages at all levels including control technology and proportional technology
- New: drives in pneumatics
- Vacuum technology
- Sensors in pneumatics
- Safety in pneumatic systems
- Mobile hydraulics
- Electrical engineering, electronics
- Circuits with contacts

### GRAFCET in various modes

- GrafEdit: create GRAFCETs in compliance with the standard
- GrafView: visualise the control sequence represented as a GRAFCET
- GrafControl: control the process with the GRAFCET, including error simulation and process monitoring
- GrafPLC

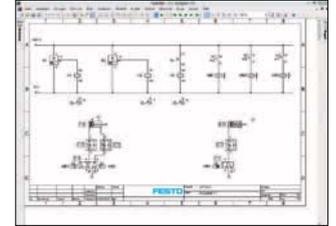


### Simulation in high definition

- Signal processing up to 10 kHz
- Virtual oscilloscope for frequencies up to 100 kHz
- Simultaneous simulation of all circuits in a project
- Simulated values can be shown at run-time
- Several switches can be operated with the joystick

### Learning material included

- Slides, pictures, animations, sectional drawings, video sequences
- Description of the physical-mathematical simulation models
- Training program for FluidSIM® beginners
- Details of all components at the push of a button
- Finished sample presentations for your training course
- Language changeover at run-time
- Multilingual (standard German/English)



### Convenient documentation

- Project administration, drawing sheets
- Individual drawing frames in all sizes
- Automatic bills of materials, flow path numbering, switching element tables, terminal diagrams, cables, wiring lists and tubing lists
- Exports into all common formats

### FluidSIM® for homework

- New expansion for administering external users over the Internet
- Administration of learning groups
- Integrated chat functions
- Simple administration by the tutor

### Pneumatics

Local installation,  
single/multiple licence de/en/es/fr

Order no. **8024357**

Network installation,  
single/multiple licence de/en/es/fr

Order no. **8024360**

### Hydraulics

Local installation,  
single/multiple licence de/en/es/fr

Order no. **8024358**

Network installation,  
single/multiple licence de/en/es/fr

Order no. **8024361**

### Electrical engineering

Local installation,  
single/multiple licence de/en/es/fr

Order no. **8024359**

Network installation,  
single/multiple licence de/en/es/fr

Order no. **8024362**

Recommended accessories:

X-Box controller	
with cable	8026542
without cable	8032252

### System requirements

- Windows XP, Vista, 7 or 8
- Processor with at least 1 gigahertz
- At least 1 GB RAM
- Dual core processor (recommended)

### We can meet your needs

Multiple licences for local or network installation with as many licences as you need.

### New languages – free of charge

In the future, you will receive new language variants free of charge on the Internet. They can be integrated into your existing version via an update.

### Visit us on the Internet.

There you will find all the information you need on currently available versions and updates for existing FluidSIM® users.

# EPLAN Education

## Education licence



### EPLAN

For more than 25 years, EPLAN has stood for innovative software solutions and service concepts for electrical and fluid engineering, planning and design. EPLAN Software & Service is the leading global technology provider in this branch. Complemented by its partnership with Autodesk in the area of mechanical design, EPLAN Software & Service also offers CAE and CAD expertise on a global scale.



**EPLAN Education** brings industrial standards to basic and further training. Trainers and teachers benefit from a comprehensive range of services, train-the-trainer and on-site software installation.

### Your advantages

- EPLAN offers users unimaginable freedom. EPLAN products not only offer a graphical approach **but also an object-orientated engineering approach**. The system proposes the best handling method for every stage of production. The user does not have to predefine anything, but has the freedom to design in a way best suited to the workflow, thus determining the system's performance rather than the system determining the design.
- Trendsetting technologies, such as the new macro variant feature, make projects uniquely flexible: **parameterisation instead of (re-) design saves time** from the outset.
- Multi-user functionality enables **multi-location, network-wide, global access to a project**. The software displays are in the corresponding language for the user.
- **Unlimited foreign language support and dictionaries** to ISO 5598 now make global engineering possible.
- EPLAN incorporates various **standards such as DIN ISO, GOST, NFPA**. With freely configurable page and component structures in accordance with VDMA standards, all possible avenues can be explored.
- The **EPLAN Data Portal** with its broad range of component data **increases the quality of your documentation and simplifies project planning**. Certified equipment and components from well-known manufacturers can be added easily via drag & drop. This saves time that would have otherwise been spent searching in various manufacturers' catalogues, entering different order numbers and generating your own macros. You have round the clock access via the Internet to device information such as parts circuit diagrams, schematic diagrams, preview images and manuals with updates is available.



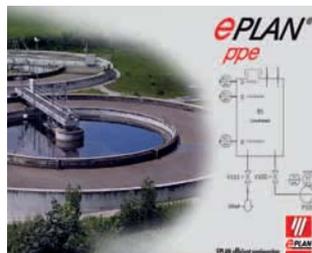
### EPLAN Electric P8

The new CAE dimension for effective project planning of complex electrical engineering control systems, including PLC, bus system and assembly planning support. A technological lead can be gained with optional graphics and object orientation, variant construction and workgroup engineering.



### EPLAN Fluid

For specialist and logic-controlled development of hydraulic, pneumatic, cooling, lubrication and refrigeration systems. EPLAN Fluid combines CAD functionality with unique logic and automates documentation, including test functions and standards compliance checks.



### EPLAN PPE

EPLAN PPE (Process Plant Engineering) represents professional planning of electrical, measurement and control technology and design of process engineering machines and systems. The EPLAN PPE engineering system supports the entire planning of a system, from the creation of system overviews, P&ID diagrams, management of process control tasks to comprehensive automation technology documentation.



### EPLAN Pro Panel

With EPLAN Pro Panel it is possible to layout mounting panels and enclosures in 3D and to derive the corresponding documentation and production drawings accurately, simply and rapidly. The optional module supports cross-discipline design of electrical engineering and fluid power – in an integrated project database.

### The EPLAN Education package

The EPLAN Education classroom licence includes the following four programs

- EPLAN Electric P8
- EPLAN Fluid
- EPLAN PPE
- EPLAN Pro Panel

The concept deftly bridges the gap between industrial practice and the requirements of basic and further training. Integrated electrical engineering, fluid engineering and electrical, measurement and control technology enable mechatronic design processes to be conveyed comprehensively.

This means that anyone, whether during training, studies or later in practical applications, can design an entire functional system, because the knowledge from the classroom can be transferred to real-life practical applications.

With a broad range of training documentation, online help and video demos.

### Scope of delivery

The EPLAN Education package contains 25 classroom network licences and 1 workstation licence for the trainer from:

- EPLAN Electric P8,
- EPLAN Fluid,
- EPLAN PPE,
- EPLAN Pro Panel.
- The software is available in 16 languages: de, en, es, fr, nl, se, ru, dk, cn, pl, pt, pt-br, cz, hu, it, kr.
- Train-the-trainer courses for the current EPLAN course plan
- On-site installation service
- Master data and sample projects
- Training materials

Completing the software service contract means you gain access to the EPLAN Data Portal, which contains engineering data from well-known manufacturers.

### Differences to the industry version

- Special data format which is not compatible with the industry version
- Limited export functions
- Water-marked printouts

### Scope of software service

- Access to the EPLAN Data Portal
- Provision of current releases and service packs free of charge
- Special concessions for training courses on updates
- HelpDesk support
- E-mail support
- Online access to special support data and information

### System requirements

- PC with Windows 7, Windows Vista or Windows XP SP3
- Dual Core processor, 2 GB RAM
- DVD-ROM disk drive
- Monitor resolution 1280 x 1024

### Get to know EPLAN for free

As a pupil, student or trainee you can obtain a free version of EPLAN, limited to the duration of your studies, in order to produce lab work and final coursework in the area of electrical engineering, fluid engineering and electrical, measurement and control technology. Using the software for commercial purposes is not permitted.

Further information at: [www.eplan.de](http://www.eplan.de)

Our range of services consists of classroom licenses and additional student and teacher licenses and the software service with different periods of validity. We will be happy to provide you with an individual offer.

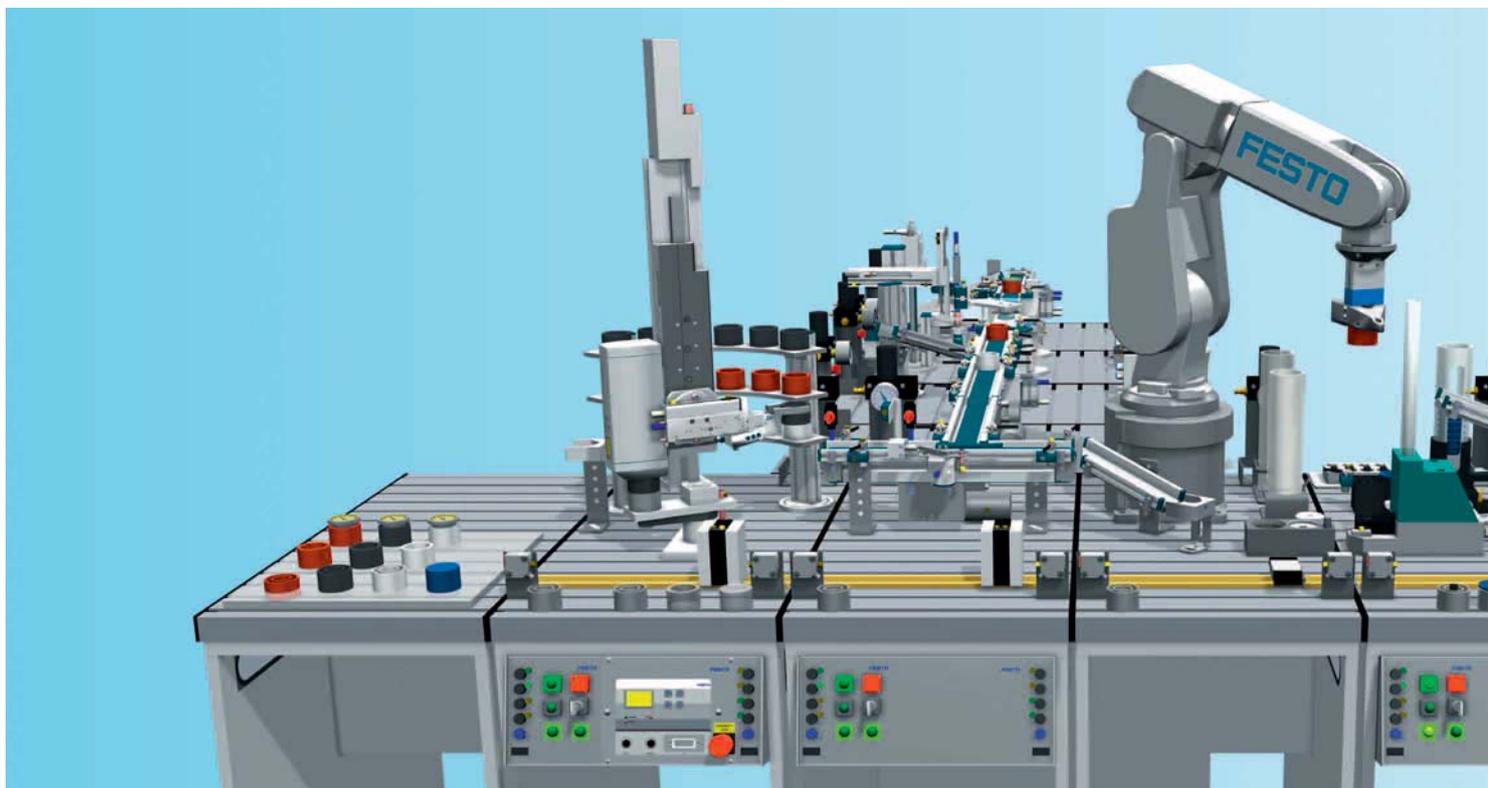
Recommended training media, also order:

EPLAN Electric P8, version 2: Practical training for beginners, de

576278

# CIROS®

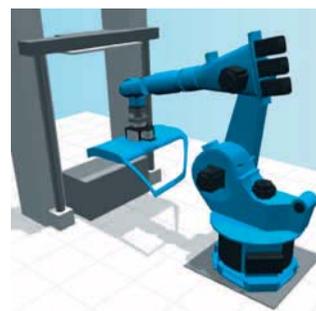
## Professional training in virtual learning environments



### The fascination of 3D simulation

Modern PC technology allows us to create realistic 3D simulations even for the most complex of automation systems. The participants discover the kinetic dynamism of mechatronic systems using virtual reality – without any risk to human or machine. This allows us to take a step into automation technology without any worries, providing a great motivational boost.

The ways we work and learn have changed – and CIROS® supports these new methods. The focus is placed on understanding things visually: the attractive representation on the PC motivates and encourages the learning process.



### Industrial practice

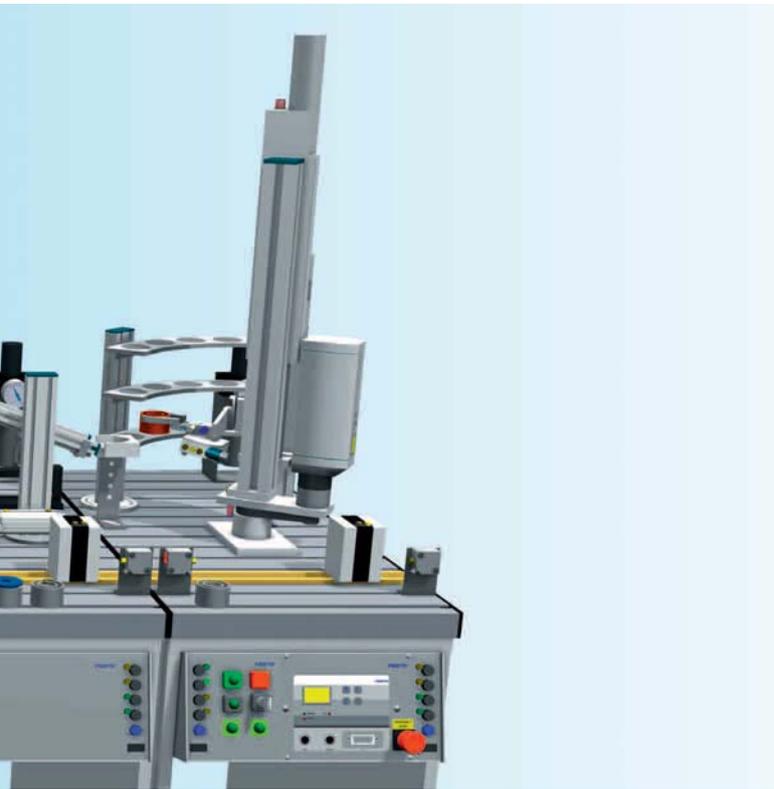
Today, simulation represents an important tool in production and product development for analysing new solutions, methods and processes in a quick and low-cost manner. Depending on the task in question, simulation systems come into play which differ from each other in terms of the level of detail of the information to be obtained and the way in which they calculate this information.

### Flexible learning

Realistic simulated learning systems broaden the possibilities in training situations where real automation systems would be stretched to their limits. They allow new training content and scenarios to be covered using simulation.

### Safe commissioning

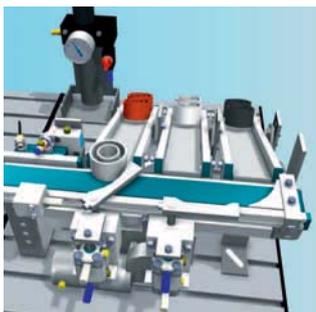
Large, fast and cost-intensive equipment is used in mechatronic systems. Despite this, robots, linear axes and transport systems can be explored and commissioned within the simulated production environment without posing any risk whatsoever to students or the installation.



**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, through the implementation of the digital factory in industrial companies and right up to real-time simulations of complex virtual worlds.



**Faults made easy**

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.



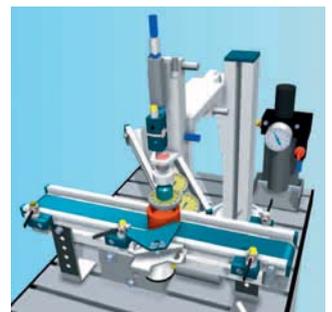
**Putting simulation to use**

While virtually commissioning industry control systems and robots, students are able to use the system simulation to develop sequencing and motion programs which can then be transferred to the control systems actually in place.



**Unlimited use**

Nowadays, any student can use a simulation program with minimum effort. At the same time, full functionality of the simulated systems is guaranteed at all times. As a result, simulation helps save costs and contributes to ensuring that the same conditions apply for all students. What's more, simulation technology can be used for almost any application.



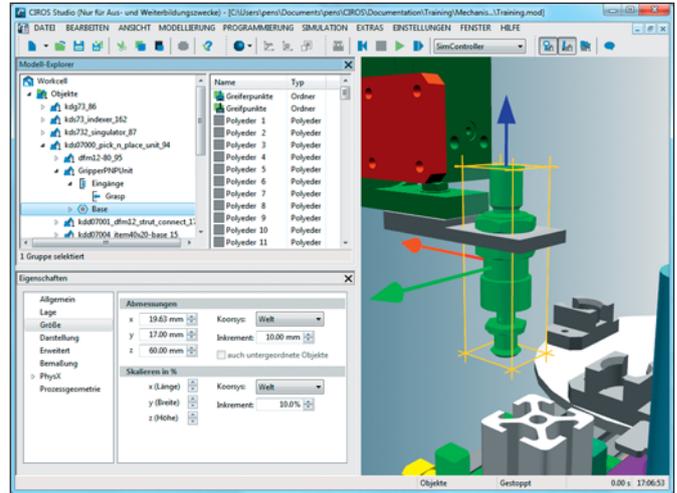
**Ready to use immediately**

After installing CIROS®, you can utilise one of the over 150 included simulation models from the factory and process automation sector for teaching and use the comprehensive model documentation.

# CIROS® Studio

## Creating virtual learning environments

New



**CIROS® Studio** is the professional tool for creating simulation models. The industrially utilised, powerful development platform unites the three tools Simulation, Modelling and Programming under one common interface.

**3D modelling** based on standardised import filters for external CAD systems:

- Import filters for STEP, IGES, VRML and STL
- Basic CAD functions
- Definition of local coordinate systems (Master Frames) for simple relative positioning of objects
- Modelling through parametrisation of the geometry, the kinematics, and the material and physical characteristics
- Libraries with industrial robot systems and numerous automation components
- Library with powerful automation mechanisms
- Export filters for DXF, STEP, IGES, VRML and STL

**3D real-time simulation** including simulation of physical effects, transport simulation, simulation of hose connections and energy chains, error simulation, sensor simulation. All 3D objects are controlled by an integrated virtual control systems via mechanical or electrical interfaces. This allows realistic experiments and analyses:

- Transport simulation is a very powerful extension to the 3D simulation core. It is used for the flexible design of any transport processes.
- Collision detection through colour change or warning messages with/without acknowledgement. Simple selection of the objects that are to be checked for collision.
- Sensor simulation: Almost all sensors, from the inductive sensor to the camera are reproduced with their physical characteristics.
- Error simulation: Creation of error scenarios as learning scenarios for strategic troubleshooting and rectification of operating errors.
- Multitasking of virtual control systems: Process models can be controlled in parallel by a number of robots and/or PLCs.
- OPC client with configuration menu for communication with any number of OPC servers for connection of any number of PLCs.

**Robot programming** that supports

- different programming languages:
- IRL (DIN 66312)
  - Movemaster Command, MELFA BASIC III, IV and V for Mitsubishi robots
  - KRL for KUKA robots
  - RAPID for ABB robots
  - V+ for Adept and Stäubli robots
  - Programming assistant with syntax checking and program editor with syntax highlighting
  - RCI Explorer for Mitsubishi robots: powerful interface to the Mitsubishi robot control systems via Ethernet TCP/IP, USB or a serial interface. With a convenient program editor, program downloads and uploads, online visualisation of robot system data, program tracking in individual step mode and automatic mode, project backups.

It contains both the virtual human with 30 independently controllable degrees of freedom and simulation of the Robotino® mobile robot platform.

**System requirements**

- Applicable for CIROS® Studio and CIROS® Education:
- Intel Core Duo 2.2 GHz processor
  - 2 GB main memory (RAM)
  - 20 GB disk space
  - Windows 7 or Windows 8 (32 or 64 bit) with Internet Explorer
  - Graphic card with 3D acceleration and full OpenGL support, e.g. NVIDIA 7800GTX, 512 MB RAM or better
  - USB interface for licence dongle or Ethernet interface for PC network when using a licence server
  - Adobe Acrobat Reader version 6.0 or higher
  - When using a licence server: Standard PC with USB and Ethernet interface for licence server

Single licence

Order no. **8038980-SSL**

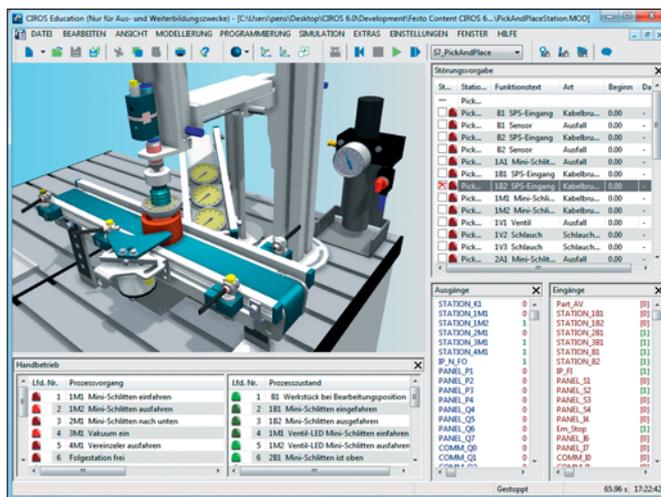
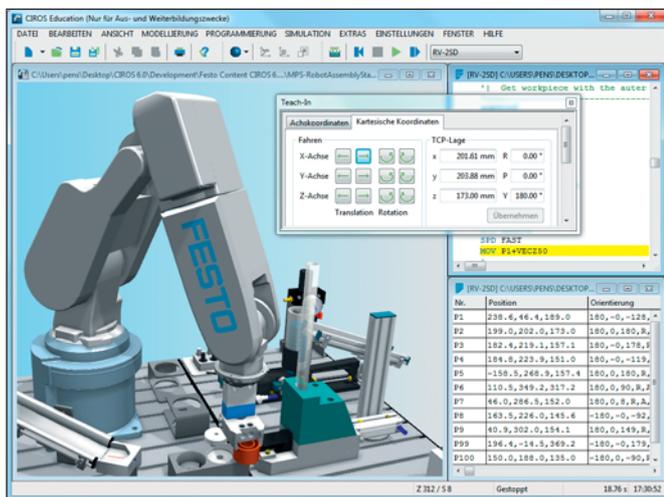
Licence extension

Order no. **8038980-SLE**

# CIROS® Education

## Applying virtual learning environments

New



**CIROS® Education** offers all functions of CIROS® Studio without the abilities of creating new models and connecting robot control systems. The main areas of application of CIROS® Education are training in:

- Robot programming
- PLC programming
- Troubleshooting
- Production planning and production control

### Training in robot programming

CIROS® Education is ideally suited for learning how to program and commission industrial robot systems. For this purpose, the program offers an integrated training program and a variety of different robot models.

- All the required basics for automation with robots are conveyed by the integrated CIROS® Robotics Assistant offering numerous graphics and animations to explain technical terms and facts, videos on a large number of industrial applications involving robots, sample programs for every model, technical documentation including instructions on processing.
- The model library with over 25 prepared robot work cells gives direct access to commissioning and programming robot applications: ranging from simple pick & place tasks right up to plants with numerous robot systems.

### Training in PLC programming

CIROS® Education is the virtual learning environment for mechatronics with a focus on PLC controlled systems. It offers an ideal working environment for PLC programming based on Siemens S7 and other manufacturers' control systems. Includes virtual learning environment for the mechatronic training system MPS®.

- The complex model library contains more than 30 process models of selected MPS® stations, various conveyor systems and an automatic warehouse.
- The models can be activated immediately from the integrated virtual S7 PLC, from STEP 7 or the TIA portal of the simulated SIMATIC Controller S7-PLCSIM or via the EasyPort from any other external hardware PLC.
- Distributed control concept: Each station has its own virtual control system with a separate program that can be modified or created from scratch at any point in time.
- Commissioning of distributed control systems: The stations can work in manual operating mode. That allows you to gradually commission the control programs in the individual stations.

### Training in production planning and production control

CIROS® allows you to link the simulation and the higher-order controller of real systems. The planning of production plants, the intralogistics, design and optimisation of Manufacturing Executing Systems (MES) as well as production management are the focus here. In CIROS®, the 3D models of your production line are created from library elements.

- The library delivers numerous manufacturing, assembly, warehouse and measuring stations for setting up an iCIM production line.
- The 3D simulation comprises all the most important components of a manufacturing system from flexible material flow up to individual sensors, and uses the complex functionality of CIROS® Studio.
- The layout module allows you to create the layout of future production lines with only a few clicks of the mouse as well as the simulation model at the same time.

CIROS® Supervision allows you to automatically create a basic version of an MES system (Manufacturing Executing System) for your production line at the push of a button. For this, the functions of a manufacturing control board with graphic process tracking and a link to the production database are used. CIROS® Supervision is supplied with CIROS® Education.

### Troubleshooting training

The powerful error simulation in CIROS® with varied error scenarios in adjustment errors for sensors. Setting errors is password-protected. Finding and rectifying errors can be logged to evaluate the results subsequently. That allows you to design an effective training for systematic commissioning and repair in the event of malfunctions within the simulation environment.

Single licence

Order no. **8038980-ESL**

Licence extension

Order no. **8038980-ELE**

12-user licence

Order no. **8038980-EL12**

25-user licence

Order no. **8038980-EL25**

# CIROS®

## Robotics applications



### What do you need?

As typical equipment for a robotics laboratory we recommend real robot work cells, for example the MPS® Robot station with optional equipment levels, as well as CIROS® Education and CIROS® Studio as a virtual learning environment for simulating a wide range of applications in industrial robotics.

For all of the users training in your laboratory at any given time you generally use a licence from CIROS® Education, which is available at the relevant student workstations. A CIROS® Studio licence 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 beginners to robot programming. They provide users with a hands-on and safe environment for learning about the fundamentals of robotics.

The other models include applications for industrial robots in the areas of dismantling, laboratory automation, packaging and welding. Robots from different manufacturers are used here. You can specify the programming languages for each model.

### Quick commissioning

Anyone who uses an MPS® Robot station in the laboratory will be able to find a suitable simulation model in CIROS® Education. The program for the real station can be developed by the user in CIROS® Education and be optimised with regard to cycle time, for example.

At the robot workstations, the real robot controller should preferably be linked to the simulation and control computer using an Ethernet connection. CIROS® Studio uses the online connection to the robot controller to transfer the program created using CIROS® Education to the robot controller. The user then checks the robot positions in the real station, adapts them if necessary and runs in his 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. If you already have a robot work cell, you can remodel it using the available robot libraries. You can use the CAD import and modelling functions in CIROS® Studio to help you.

CIROS®

## Automation technology applications



#### From hardware-in-the-loop to completely virtual

CIROS® supports different scenarios for PLC simulation and offline programming for PLC-controlled automation technology installations. A real PLC can be coupled with CIROS® via EasyPort. In this 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.

# Programming software

## Siemens



Cooperates  
with Education

SIEMENS

Automation

Interchangeable usage of  
STEP 7 Professional 2010  
(Classic) and STEP 7  
Professional TIA-Portal.

### System requirements for STEP 7 Professional 2010

- PC with Windows 7 Professional, Enterprise, Ultimate
- At least Pentium 4 with 1,7 GHz
- At least 1 GB RAM
- At least 1024 x 768 Pixel

### System recommendations for STEP 7 Professional TIA-Portal

- PC with Windows 7 Professional, Enterprise, Ultimate/ Windows 8.1 Professional, Enterprise
- Intel Core i5-3320M with 3,3 GHz or comparable
- 8 GB RAM
- 1920 x 1080 Pixel
- 64 Bit operating system

### STEP 7 Trainer Package

The STEP 7 Trainer Package for 12 users contains the programming languages Statement List (STL), Function Chart (FCH) and Ladder Diagram (LDR) as well as STEP 7-SCL, STEP 7-GRAPH, Distributed Safety, S7-Technology software package and distributed intelligence iMap. It facilitates the realisation of networked solutions with SIMATIC S7-1500/1200/300/400, SIMATIC C7, SIMATIC WinAC. The Trainer Package also contains the S7-PLCSIM simulation software. Using the simulation software S7-PLCSIM it is possible to carry out the functional test of the SIMATIC S7 user blocks on PG/PC regardless of the availability of the target hardware. Detection and elimination of program errors are therefore possible at a much earlier stage in development. The Trainer Package contains 60 copies (3 x 20 licences) of the STEP 7 Software for Students (365-day licence).

S7-PLCSIM can be used for all user blocks and a selection of existing system functions which have been created in one of the following programming languages: STL, LDR, FCH, STEP 7-GRAPH, STEP 7-HiGraph, STEP 7-SCL.

The software and documentation are supplied on DVD whilst the floating licence is supplied on a USB stick (de/en/fr/es/it).

Intended for non-industrial educational users only.

de/en/fr/es/it **548573**

### STEP 7 Trainer Package Upgrade

To the current version of the STEP 7 Trainer Package.

Prerequisite: Trainer package for 12 students.

Intended for non-industrial educational users only.

The Trainer Package contains 60 licences (3 x 20) for the STEP 7 Software for Students (365-day licence).

For 12 students. Scope as for STEP 7 Trainer Package (order no. 548573).

de/en/fr/es/it **548574**

### STEP 7 Software for Students

The trial licence for 365 days includes the programming languages Statement List (STL), Function Chart (FCH) and Ladder Diagram (LDR), STEP 7-SCL, STEP 7-GRAPH, as well as the S7-PLCSIM simulation software.

The software and documentation are supplied on DVD, whilst 20 floating licences are supplied on a USB stick (de/en/fr/es/it).

Prerequisite: S7 Trainer Package for 12 users.

Intended for non-industrial educational users only.

de/en/fr/es/it **548576**

### STEP 7 Professional for Training

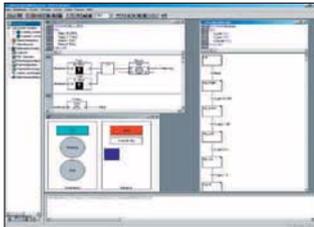
Contains the programming languages Statement List (STL), Function Chart (FCH) and Ladder Diagram (LDR) as well as STEP 7-SCL, STEP 7-GRAPH, iMap, Distributed Safety, S7-Technology software package and S7-PLCSIM.

The software and documentation are supplied on DVD whilst the floating licence is supplied on a USB stick (de/en/fr/es/it).

Intended for industrial educational users.

de/en/fr/es/it **548575**

# Programming software



**CODESYS®**  
provided by Festo  
The Codesys® software for the CPX-CEC range of controllers

allows standardised programming in accordance with IEC 61131-3. Optimised for the configuration, programming, commissioning and maintenance of pneumatic and electrical automation solutions.

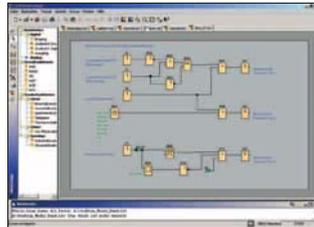
#### Your advantages

- Thanks to the IEC 61131-3 standard, Codesys® is flexible and can be used for all kinds of control tasks
- Very simple to commission and program
- Ethernet communication for simple programming, module library included
- Module library for electric drives

#### The following functions and languages are supported

- Ladder diagram
- Structured text
- Sequential function chart
- Continuous function chart
- Function block diagram
- Integrated visualisation
- Trace functions
- Offline simulation
- All programming languages can be used in combination with one another
- Simultaneous conversions possible
- All standard data types: BYTE, WORD, DWORD, SINT, USINT, INT, UINT, DINT
- Symbolic operands with no length restriction
- Context-sensitive help functions
- Global search and replace
- Disc space check prior to download
- Unlimited number of function parameters

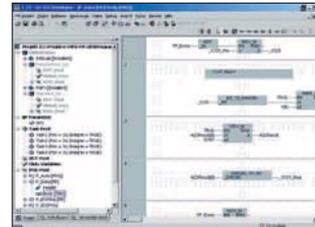
Free download



#### LOGO! Soft Comfort V8

- Easy operation in single mode and simple project planning in network mode
- Intuitive programming and configuration of the many functions, fast and easy interconnection at the click of a mouse
- Automatic configuration of communication and representation in the network view
- Up to three programs can be displayed side by side, whereby signals can be dragged from one program and dropped into another
- Programs from previous versions can be used

Order no. **8040050**



#### Mitsubishi GX Trainer Package

The standard programming software for controller type FX from Mitsubishi includes GX Developer for the programming of AWL, FUP, KOP, as well as GX IEC Developer, the powerful development environment to IEC 61131 (AWL, FBS, KOP, AS, ST). The Trainer Package consists of six full licences and six student versions on separate CD-ROMs for doing homework.

#### Scope of delivery:

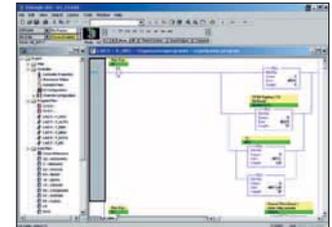
- GX IEC Developer (de/en)
- GX IEC Developer for students (de/en)
- GX Developer (de/en)
- GX Developer for students (en)
- Manual on CD-ROM (de/en)

#### System requirements

- PC with Win 98/ME/NT/2000/XP
- At least PentiumII 450 MHz
- 64 MB RAM
- 150 MB free space on hard disk

The Trainer Package is intended exclusively for basic and further training.

de/en **541149**



#### RSLogix 500 Starter

The programming software for the Micro Logix controller type by Allen-Bradley contains the RSLogix 500 Starter as well as RS Linx Lite for programming LDR. The CD-ROM (en) manual incorporates Getting Results with RSLogix 500.

#### System requirements

- PC with Win NT/2000/XP
- At least Pentium II 500 MHz
- 128 MB RAM
- 45 MB free space on hard disc
- 3.5" floppy disc drive

en **535829**

#### RSLogix 5000 Mini Edition

RSLogix 5000 is the programming software for the CompactLogix controller type from Allen-Bradley. RSLogix 5000 Mini Edition allows programming using a ladder diagram.

#### System requirements

- PC with Windows 2000/XP/Vista
- At least Pentium II 450 MHz
- At least 128 MB RAM
- 3 GB free space on hard disk
- DVD drive

en **8034584**

#### RSLogix 5000 Lite Edition

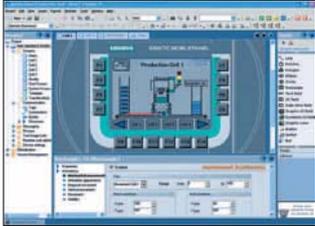
RSLogix 5000 is the programming software for the CompactLogix controller type from Allen-Bradley. RSLogix 5000 Lite Edition allows programming using a ladder diagram, function block diagram, sequential function chart and structured text.

#### System requirements

- PC with Windows 2000/XP/Vista
- At least Pentium II 450 MHz
- At least 128 MB RAM
- 3 GB free space on hard disk
- DVD drive

en **8034585**

# Visualisation software



### Trainer Package

#### WinCC flexible/WinCC Advanced

Consistent family of engineering tools for project planning of SIMATIC HMI operator units and the PC-based visualisation systems WinCC Runtime Advanced and WinCC Runtime Professional.

- 6x combined licence for switchable use of SIMATIC WinCC flexible 2008 (Classic) and SIMATIC WinCC Advanced (TIA Portal)
- 6x option and run-time software
- 2x 20 SIMATIC WinCC Advanced/WinCC flexible 2008 SP3 for students (temporary with authorisation for 365 days)

#### System requirements

- SIMATIC WinCC flexible 2008: Windows 7 Professional, Enterprise (not N), Ultimate SP1
- SIMATIC WinCC advanced: Windows 7 Professional, Enterprise (not N), Ultimate SP1/Windows 8.1 Professional, Enterprise

Authorisation on USB stick

Order no. **556239**

### Trainer Package Upgrade

#### WinCC flexible/WinCC Advanced

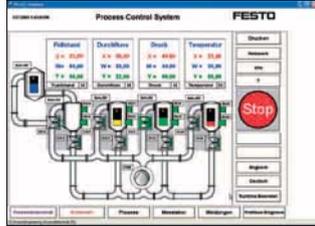
6x Upgrade from SIMATIC WinCC flexible 2008 and SIMATIC WinCC Advanced V11 and V12 to Advanced V13.

#### System requirements

- SIMATIC WinCC flexible 2008: Windows 7 Professional, Enterprise (not N), Ultimate SP1
- SIMATIC WinCC advanced: Windows 7 Professional, Enterprise (not N), Ultimate SP1/Windows 8.1 Professional, Enterprise

Authorisation on USB stick

Order no. **8040062**



### WinCC

SIMATIC WinCC is a PC-based control and monitoring system designed for the visualisation and control of processes, production sequences and machines.

The package consists of a configuration (development) system and a runtime system for 2048 variables (PowerTags).

Supplied on DVD, without documentation. Detailed documentation and configuration manuals on request.

#### System requirements

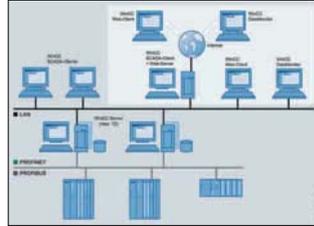
Windows 7 Professional, Enterprise, Ultimate (32 bit/64 bit), Windows XP Professional (32 bit)

1 licence,de/en/es/fr/it

Order no. **195439**

6 licences (Trainer Package),de/en/es/fr/it

Order no. **195442**



### Trainer Package

#### WinCC/Web Navigator

Systems operation and monitoring via the Internet, in-house intranet or LAN connection using SIMATIC WinCC.

- 6x WinCC Complete Version RC 2048 Variables
- 6x WinCC/Web Navigator Diagnostics Server
- 6x WinCC/Web Navigator Diagnostics Client

#### System requirements

Windows 7 Professional, Enterprise, Ultimate (32 bit/64 bit), Windows XP Professional (32 bit)

Order no. **556238**



### Wonderware InTouch® HMI

InTouch is an interactive system for visualising, monitoring and controlling industrial processes.

The package comprises the InTouch development and runtime version for Windows with 512 PLC variables. A comprehensive library with over 500 "intelligent" and individually adaptable graphic and object symbols is also included.

The package includes a manual and there are context-related help texts in the software. Supplied on DVD with USB licence dongle in the mini-systemainer.

#### Also order:

InTouch manual containing detailed descriptions of how to use the software and the functions for the creation of visualisation applications (order no. 95242 en)

#### System requirements

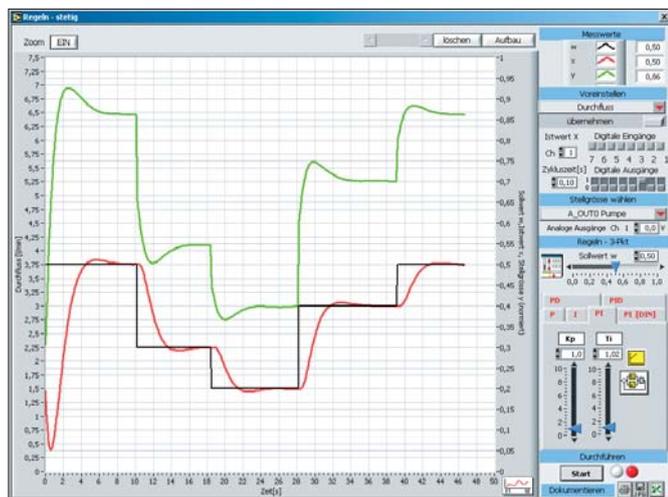
- Win XP SP3 Professional 32 bit/Win Vista SP2 Business or Ultimate 32 or 64 bit/Win 7 SP1 Professional or Ultimate 32 or 64 bit
- PC with at least a 1.2 GHz processor
- At least 1 GB RAM
- At least 100 GB of free hard drive space
- Graphics card and monitor with Super VGA resolution (1024 x 768) or better
- CD-ROM or DVD drive (for installation)

Single licence de/en **567426**

6-user licence de/en **567427**

Special licence rules apply for schools and educational institutes in the commercial sector.

## FluidLab®-PA closed loop Control engineering in focus



Using FluidLab®-PA step by step to teach and demonstrate the fundamentals of control technology. The EasyPort is used to connect the PC and real hardware, e.g. the EduKit PA, the MPS® PA compact workstation or the MPS® PA filtration station, mixing, reactor, filling.

### Settings

Parametrisation of sensor values with factor and offset to represent the physical quantities as well as signal attenuation per median filter for the analogue input signals. Display of the physical value in the variable units field. Other possible settings are the inversion of the controller direction, Y offset in the continuous rules and the selection of the simulation mode.

### Menu: Measurement

All binary and analogue process data, for example the signal statuses of the sensors, process fittings and pump, can be displayed graphically and evaluated directly. To record the sensor characteristic and determining a step response, functions are available such as selection of measuring channels, adjusting the test time or cursor evaluation with zoom function.

### Menu: Characteristic curve

The characteristics of a final control element (e.g. pump or proportional valve) is investigated in various perspectives (voltage for flow, flow for pressure, pressure for voltage).

### Menu: 2-point controller

Typical applications are level and temperature controlled systems.

### Menu: Continuous regulation

Experimentation, configuration and optimisation of the control processes (P, PI, PD or PID controller) with immediate effect in the process. Controlled systems can be operated via mouse click. Trouble-free documentation of the control parameter is possible. The measured values and curve profiles can be documented comprehensively. The **block diagram** can be displayed as a function menu for all continuous controllers with current numerical values.

### Industrial controller functions

System operation like in a process control system. It is possible to specify nominal values, display warning limits and switch the controller between manual and automatic.

### Simulation

A simulated process model illustrates the sequence identically to the operation of the real hardware.

FluidLab®-PA for **MPS® PA stations** is included.

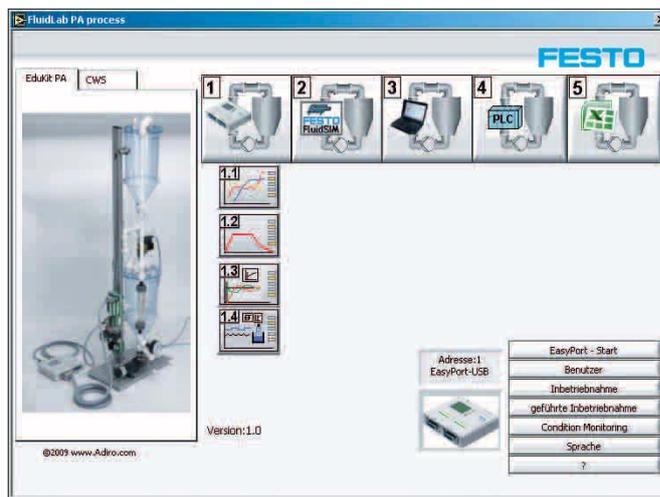
Single licence on CD-ROM de/en/es/fr/sv

Order no. **544304**

8+1 Multiple licence on CD-ROM  
de/en/es/fr/sv

Order no. **567139**

## FluidLab® PA process Getting started in process engineering



### Simple application of complex relationships

The clear menu structure proceeds from the commissioning of the EduKit PA or Compact workstation to the process engineering using the example of a bottling plant.

### Menu: Guided commissioning

A check list like in the industry. After processing, the system is activated. A commissioning protocol can be printed out for documentation.

### Condition monitoring

Safety and efficiency are checked by means of permanent recording of machine status. Detect and analyses deviations with FluidLab®-PA process.

### Menu: Operation, open- and closed-loop control with the EasyPort

Experience the behaviour of a system using simple process examples. Control-technology operations and continuous and discontinuous controllers are presented. Subsequent analyses bring a valuable, basic realisation, which can be transferred to the general technology. Especially general training aims, such as the concentrated observation and analysis of systems, are encouraged.

### Menu: FluidSIM®

Develop and immediately test control-technology relationships – whether virtual or real. Program one's own process sequence in FluidSIM®: electrical circuit diagram, logic diagram and GRAFCET.

### Menu: Virtual reactor

Animated by a sequencer – observing, analysing and documenting the simulated processes. Production according to customer order and assessing and responding to error messages are in demand.

### Menu: Virtual PLC – acting with STEP 7, PLCSIM or CODESYS® simulation

Learn the basics of PLC programming and the logical processing of binary and analogue signals. Test the program on a virtual or real model.

### Menu: Filling with Excel interface

FluidLab®-PA is transmitted order data from MS Excel via the DDE interface, e.g. the number and volume of the bottles. Conversely, the current status of the plant, for example the level of the storage tanks, is reported.

FluidLab®-PA for **MPS® PA stations** is included.

Single licence on CD-ROM de/en/es/fr

Order no. **567224**

8+1 Multiple licence on CD-ROM  
de/en/es/fr

Order no. **567225**

# EasyPort USB

## Interface for measuring, open-loop control, closed-loop control



### Connection of software/simulation with actual training equipment/all PLCs

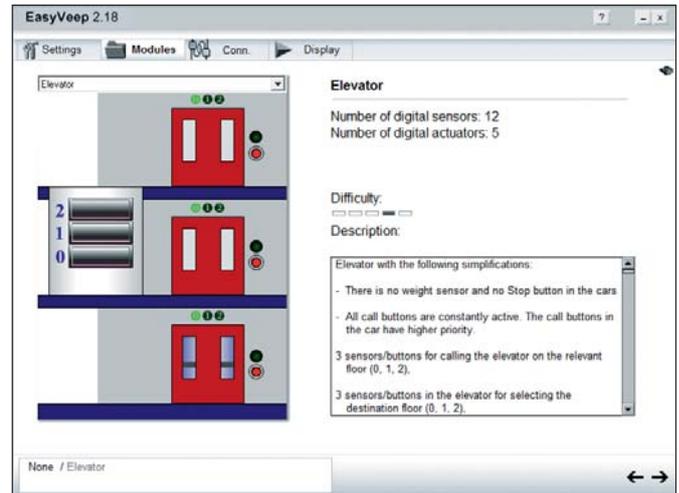
The principle is simple: the USB interface is connected to the PC. The connection to the automation equipment is via standard SysLink connectors. Input and output signals can thus be read into and output from a PC. So that EasyPort can adapt to different situations, we have developed software for the 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
- Analogue interface: sub-D 15-pin socket, 12 bit resolution, 4 analogue inputs, 2 analogue outputs, sample frequency 0.5 kHz
- Digital interface: 16 digital inputs, 16 digital outputs on 2 x 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
- However, for installation in a 19" support system
- Front plate: 19" plate with 36 HP

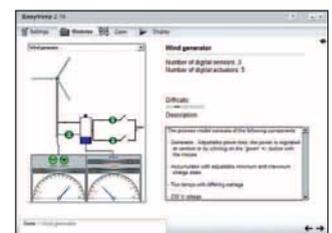
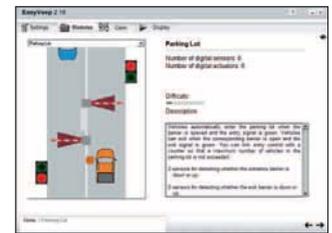


### Control of numerous practical process model

Numerous practical process models can be controlled using any PLC using EasyPort and the EasyVeep® simulation software included in scope of delivery. The models are documented and meet a broad range of requirements.

Easy Veep is easy to install and offers exciting fields of application. The topics covered include the following:

- 7-segment display
- Alarm systems
- Level crossings
- Lifts
- Garage doors
- Multi-storey car parks
- Sluice gates
- Sorting systems
- Hot water tanks
- Washing machines
- Wind generators
- and much more



# Connects the simulation to the real world

Example applications	Measuring	Control (open loop)	Closed-loop control	Controlling a simulation
<b>PC: Software and simulations</b>	– 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	– EasyVeep® – FluidSIM® – CIROS® – LabVIEW – C++ – Visual Basic
<b>Interface: EasyPort USB</b>	Interface: USB  Interface: digital/analogue	Interface: USB  Interface: digital/analogue	Interface: USB  Interface: digital/analogue	Interface: USB  Interface: digital
<b>Real training equipment</b>	– Simulation box, digital/analogue – MPS® PA – TP 210 – TP 610  EasyPort USB is the PC interface for receiving analogue measurements and digital signals.  Measurement data logged via: – FluidLab®-PA – FluidLab®-P – FluidLab®-H	– Simulation box, digital/analogue – 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/analogue – 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 → Page 223  Simulated process, displayed via: – CIROS® – FluidSIM® – EasyVeep®

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: EasyVeep®, 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
Analogue 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 SimuBox:

Analogue 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
-------------------------	--------

# Teachware

## Teaching materials for basic and advanced training



### Theory and practice, our range

- Pneumatics
- Hydraulics
- Electrical engineering/Electronics
- Automation/PLC
- Mechatronics/Process automation
- CNC technology/Equipment

A wide range of different teaching materials for ongoing basic and advanced training are available for these topics.



### Technical literature and textbooks

The technical literature and textbooks provide the basis for studying technologies and processes. For trainers and teachers, they are essential for preparing courses. They also provide anyone who does not enjoy self-study on a PC with professional guidelines for their practical exercises.



### Workbooks

At the cutting edge for more than 40 years: Festo Didactic's training packages with equipment sets and tailored workbook with exercises and sample solutions (including CD-ROM). The exercises are based on industrial practice and have been successfully used in numerous courses for training specialist staff.



### Dictionaries and manuals

Symbols, rules, standards, formulae ... You don't need to have everything in your head, but you do need to know where to find it!



### Legal security for you

Festo Didactic's teaching materials are already in widespread use for a diverse range of purposes. With the new licences, the legal basis for your individualised use has now been established. From now on, you have the option of choosing one of three types of licence, to ensure an optimised – and legally secure – use of Festo's teaching materials tailored to your needs.

You can choose from the following types of licence:

#### HomeUse licence

For personal use. The advantage to you: a lower price for the PDF of the training material.

#### Campus licence

The standard option for commercial (professional) use. For all those wishing to use the training materials at a single location.

#### Enterprise licence

For large (international) companies and educational institutions with multiple locations.

For information on each of the licence types, please see the following table.

#### Note:

- The licence types are valid for all Festo Didactic training materials.
- The full rights of use are set out in the legal information contained in the purchased training materials.

Properties	HomeUse licence	Campus licence	Enterprise licence
Scope of delivery	PDF document (exercises/worksheets, sample solutions)	Teaching material (workbook with multimedia CD-ROM*)	As agreed
Document protection	Watermark	–	–
Document can be modified	X	X	X
Reproduction rights	–	X	X
Multilingual version*	–	–	X*
Target group	Private individuals	Commercial/educational organisations (single location)	Commercial/educational organisations (multiple locations)
Price	On request	On request	On request
Shop	<b>PayPal</b> <sup>™</sup>	<b>FESTO</b>	<b>FESTO</b>

\* The languages offered vary depending on the training material.

# Pneumatics

## Workbooks



### Pneumatics, Basic level TP 101

Nineteen project-orientated exercises, increasing in complexity and suitable for equipment set TP 101, are the ideal introduction to pneumatics. Real problem descriptions with positional sketch, concrete project tasks and detailed aids for professional implementation provide the ideal preparation for a real-life industrial environment.

The workbook includes:

- Sample solutions
- Training notes
- Multimedia CD-ROM with graphics, photos of industrial applications, animations and FluidSIM® circuit diagrams
- Exercise sheets for trainees

W. Haring, M. Metzger, R.-C. Weber  
Edition 2012, 284 pages, in colour,  
in folder.

Campus licence (→ Page 53):

de	540671
en	541088
es	542503
fr	542507



### Pneumatics, Advanced level TP 102

Building on from Basic Level Pneumatics, there are ten additional, demanding tasks in the Advanced Level. The documentation is directed at advanced pneumatics technicians. Newly added to the updated edition are the revised exercise sheets for practical use in the classroom. The workbook contains a sample solution for each of the exercise sheets. The TP 101 – Pneumatics, Basic Level and TP 102 – Hydraulics, Advanced Level equipment sets are needed to carry out the tasks.

The workbook includes:

- Sample solutions
- Training notes
- Multimedia CD-ROM with graphics, photos of industrial applications, animations and FluidSIM® circuit diagrams
- Exercise sheets for trainees

W. Haring, M. Metzger, R.-C. Weber  
Edition 2012, 204 pages, in colour,  
in folder.

Campus licence (→ Page 53):

de	540672
en	541089
es	542504
fr	542508



### Electropneumatics, Basic level TP 201

Twelve project-orientated exercises, increasing in complexity and suitable for equipment set TP 201, are the ideal introduction to electropneumatics. Real problem descriptions with positional sketch, concrete project tasks and detailed aids for professional implementation provide the ideal preparation for a real-life industrial environment.

The workbook includes:

- Sample solutions
- Training notes
- Multimedia CD-ROM with graphics, photos of industrial applications, animations and FluidSIM® circuit diagrams
- Exercise sheets for trainees

M. Pany, S. Scharf, R.-C. Weber  
Edition 2012, 270 pages, in colour,  
in folder.

Campus licence (→ Page 53):

de	540673
en	541090
es	542505
fr	542509



### Electropneumatics, Advanced level TP 202

Building on from Basic Level Electropneumatics, there are 12 additional, demanding tasks in the Advanced Level. The documentation is directed at advanced pneumatics technicians. Newly added to the updated and revised edition are the revised exercise sheets for practical use in the classroom. The workbook contains a sample solution for each of the exercise sheets. The TP 201 – Electro-pneumatics, Basic Level and TP 202 – Advanced Level equipment sets are needed to carry out the tasks.

The workbook includes:

- Sample solutions
- Training notes
- Multimedia CD-ROM with graphics, photos of industrial applications, animations and FluidSIM® circuit diagrams
- Exercise sheets for trainees

M. Pany, S. Scharf, R.-C. Weber  
Edition 2012, 298 pages, in colour,  
in folder.

Campus licence (→ Page 53):

de	540674
en	541091
es	542506
fr	542510

Reading samples at:  
[www.festo-didactic.com](http://www.festo-didactic.com)



### Pneumatic drives, TP 220

Describes in detail the issues and projects in 16 exercises closely linked to industrial practice, each comprising a problem description and work assignment. Worksheets support the students through the required stages of planning, execution and monitoring. Includes sample solutions and detailed background knowledge for the theoretical fundamentals.

The workbook includes:

- Sample solutions
- Training notes
- Multimedia CD-ROM with graphics, photos of industrial applications, animations and FluidSIM® circuit diagrams
- Exercise sheets for trainees

F. Ebel, J. Hasel  
Edition 2007, 340 pages, in colour, in folder.

Campus licence (→ Page 53):

de	549982
en	559880
es	559881
fr	559882



### Basics of vacuum technology, TP 230

In addition to six comprehensive project tasks for step-by-step construction and testing of the vacuum system, the package also includes basic information on the following topics:

#### Getting started in vacuum technology

- Basic concepts of vacuum technology
- Vacuum ranges
- Vacuum generation in handling technology
- Vacuum pumps
- Functional principle of displacement pumps
- Instructions on selecting pumps
- Ejectors, ejector units

#### Vacuum elements

- Valves for vacuums
- Measuring and storing a vacuum
- Suction grippers
- Vacuum generation

The workbook contains:

- Basic information
- Sample solutions
- Training notes
- Multimedia CD ROM with graphics and photos of industrial applications
- Worksheets for students

R.-C. Weber  
Edition 2011, 140 pages, in colour, in folder.

Campus licence (→ Page 53):

de	567257
en	567258
es	567260
fr	567259



### Sensors in pneumatics, TP 240

Ten projects based on industrial examples, suitable for equipment set TP 240, each including problem descriptions, parameters and project tasks, deal in detail with the specific subject of sensors in pneumatic control-system environments. The topics of pressure sensors, flow sensors, analogue position transmitters for pneumatic cylinders, signal converters and sensors for vacuum technology are covered comprehensively. Each worksheet in the book of exercises has a sample solution in the workbook.

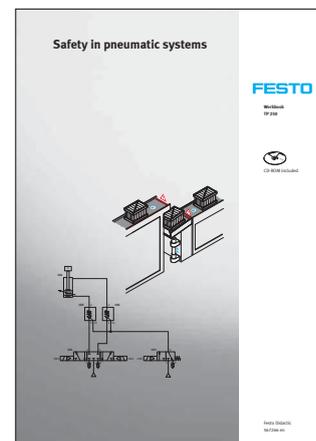
The workbook includes:

- Sample solutions
- Training notes
- Multimedia CD-ROM with graphics and photos of industrial applications
- Exercise sheets for trainees

F. Ebel,  
Edition 2009, 194 pages, in colour, in folder.

Campus licence (→ Page 53):

de	566909
en	566910
es	566912
fr	566913



### Safety in pneumatic systems, TP 250

The workbook contains eight project tasks that build on each other, together with the solutions for each exercise sheet. In these exercises, students reduce the potential risk level of a pneumatic system step by step. The basic level contains the following topics: overview of relevant standards, laws and regulations; overview and detailed description of operating modes; overview and detailed description of ten relevant safety functions; possible technical solutions for each safety function; extensive illustrations and cross-sections to explain the design principles.

The workbook contains:

- Basic information
- Sample solutions
- Training notes
- Multimedia CD ROM with graphics, photos of industrial applications, safety guidelines, safety poster
- Worksheets for students

R.-C. Weber  
Edition 2012, 178 pages, in colour, in folder.

Campus licence (→ Page 53):

de	567265
en	567266
es	567267
fr	567268

# Pneumatics

## Textbooks, Workbooks, Working material



### Basic principles of pneumatics and electropneumatics

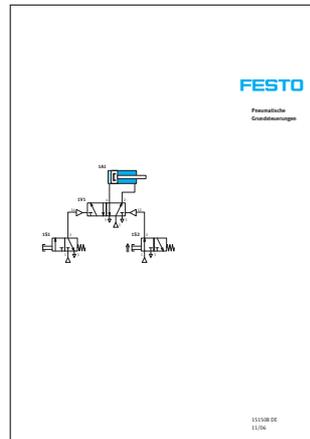
#### Textbook

- For use in vocational schools, technical colleges, schools for master craftspeople and in company-wide training
- Conveys the essential basic principles of pneumatics and electropneumatics
- Contains technical and mathematical content, application examples, workflow descriptions, safety measures for electropneumatic control systems as well as overviews of the relevant symbols and circuit symbols
- Also presents in detail the design of circuit diagrams and individual pneumatic components
- Takes into account the change in the requirements and technical developments in electropneumatic control systems

**Also order:**  
FluidSIM® Pneumatics.  
This software enables you to design and simulate the sample circuits supplied on a PC.  
→ Page 36

F. Ebel, S. Idler, G. Prede, D. Scholz  
Edition 2013, 212 pages, in colour, bound.

de	567028
en	573030
es	573031
fr	573032



### Basic pneumatic controllers

#### Practical knowledge

This booklet has been created for practitioners who need to implement small projects quickly and effectively. The various circuit examples facilitate the creation of many simple tasks. The examples shown are complementary. If something is not clear, the previous step can be referred to. This means that even those with little experience can quickly get to grips with the subject matter.

#### Reference work for circuit planning symbols

A detailed overview of the most important circuit planning symbols shows the structure of controllers and gives hints on the practical implementation of circuit diagrams that have been developed.

W. Braungard, P. Löbelenz, G. Mark  
Edition 2006, 80 pages, booklet.

de	151508
----	--------



### Closed-loop pneumatics

#### Workbook

The 21 exercises contained in this workbook offer a practical introduction to closed-loop control pneumatics. Besides fundamentals, the workbook also covers subjects such as the function of various controllers and control circuits, empirical setting of controller parameters and the influence of interference variables. You will need equipment set Closed-loop control pneumatics, TP 111 to carry out the exercises.

The workbook includes:

- Sample solutions
- Training notes
- Multimedia CD-ROM with supplementary media
- Exercise sheets for trainees

J. Gerhartz, D. Scholz  
Edition 2001, 542 pages, in folder.

Campus licence (→ Page 53):

de	94459
en	94465
es	533499
fr	94347



### DVD Electropneumatics/ Electrohydraulics, Basic level

This video primarily covers electrical controllers. In addition to an introduction to electrical engineering, it shows the most important switching elements and basic circuits. Practical applications alternate with animations and circuit examples.

The DVD is multilingual (de, en, es, fr, it, tr, cn, ru). The language can be selected.

48 minutes

Order no. **538487**



### Case of cutaway pneumatic models

For visualising the structure and function of pneumatic components.

All of the cutaway models used are of industrial design. Dynamic elements and wearing parts correspond to the original. The models selected are those relevant to pneumatic training. Some of the cutaway models retain their function or partial function so that they can be demonstrated in use.

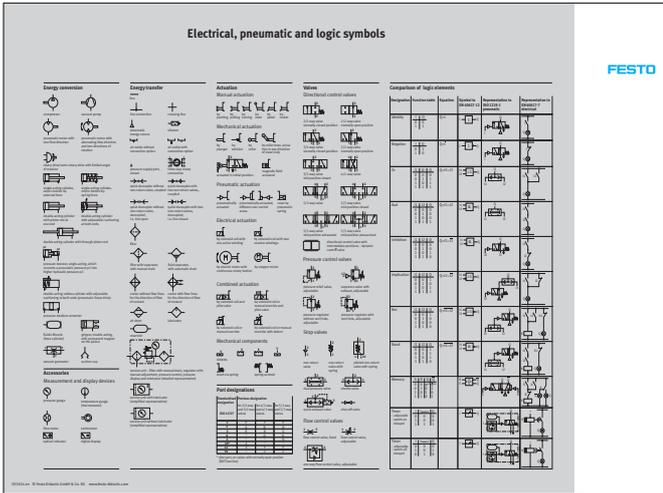
The following components are included in a case of cutaway models:

- Single and double-acting cylinders
- Filter regulator
- AND gate
- OR gate
- Delay valve
- Quick-exhaust valve
- Valve slice
- Pressure gauge
- Roller lever valve
- Pressure sequence valve
- Pneumatic valve
- One-way flow control valve

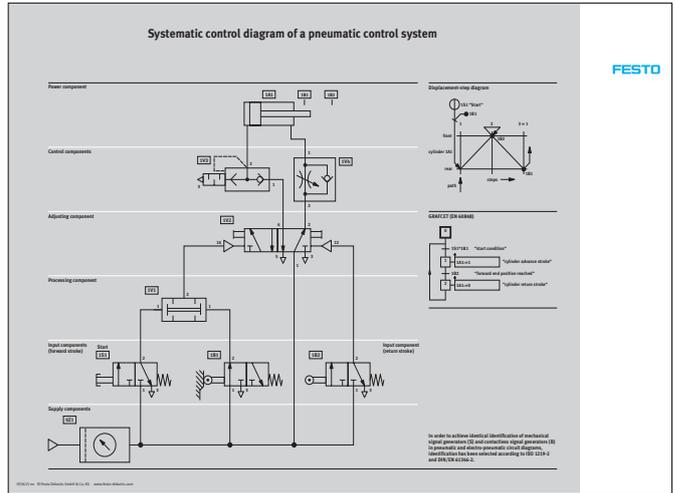
Order no. **539007**

# Pneumatics

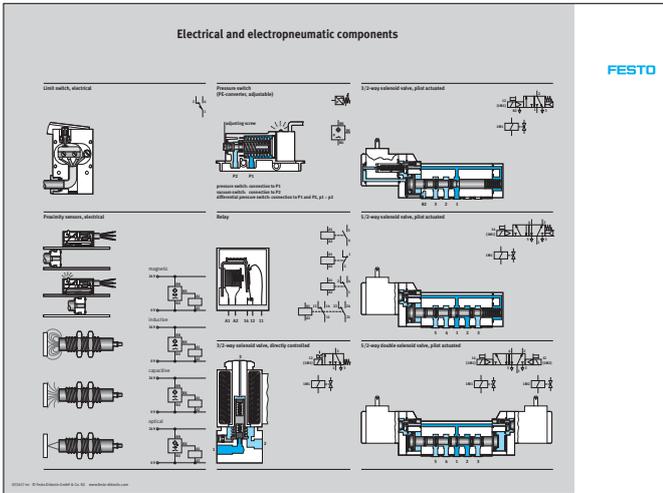
## Set of posters



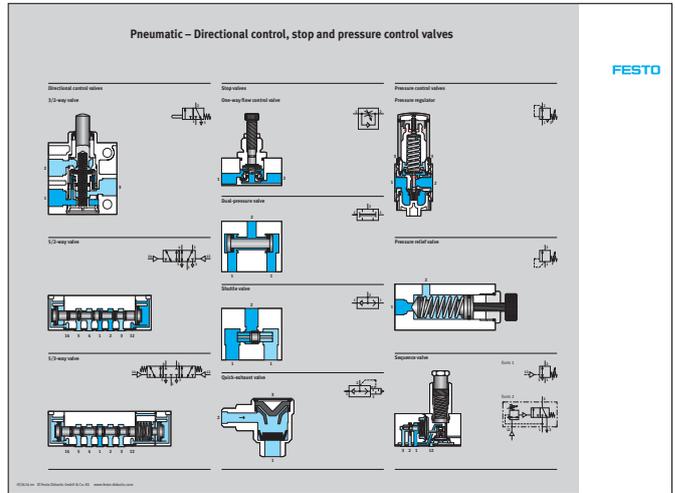
FESTO



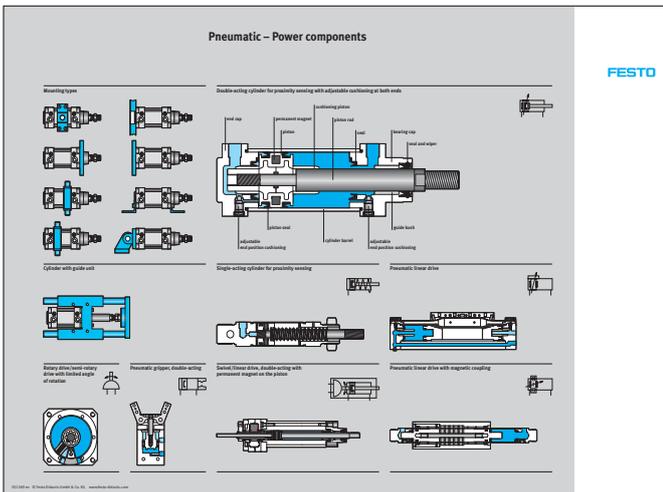
FESTO



FESTO



FESTO



FESTO

**Everything that you need to know: 5 posters on pneumatics**

Now the updated version of the popular A1 poster is supplied rolled up, quickly providing a comprehensive overview. All symbols and terminology correspond to the current standards ISO 1219-2 and DIN/EN 61346-2.

- Subjects on the poster:
- Electrical, pneumatic and logic symbols
  - Systematic control diagram of a pneumatic control system
  - Electrical and electropneumatic components
  - Pneumatic - Directional control, stop and pressure control valves
  - Pneumatic - Power components

de	193129
en	551015
es	551014
fr	551013

# Hydraulics Textbooks



## Fundamentals of hydraulics and electrohydraulics Textbook

This textbook teaches the main fundamentals of hydraulics and electrohydraulics in a clear manner:

- Physical fundamentals of hydraulics
- Fundamentals regarding hydraulic fluids
- Components of the power supply section
- Drives, pressure regulators, directional control valves, shut-off valves, flow control valves, proportional valves as well as characteristic values and designs
- Fundamentals of electrical engineering and electrical components
- Workflow descriptions for processing machines and production systems
- Circuit symbols and layout of circuit diagrams
- Safety measures for electrohydraulic control systems

**Also order:**  
FluidSIM® Hydraulics.  
This software enables you to design and simulate the sample circuits supplied on a PC.  
→ Page 36

Renate Aheimer, Christine Löffler, Dieter Merkle, Georg Prede, Klaus Rupp, Dieter Scholz, Burkhard Schrader  
2012 edition, 232 pages, in colour, bound.

de	574180
en	574181
es	574182



## Proportional hydraulics, Basic level Textbook

How can speed be controlled? How is a position held? How is leakage avoided? Where and when can energy be conserved? This book provides a clear and easy-to-understand introduction to the fundamentals of proportional hydraulics.

D. Scholz  
Edition 1997, 123 pages, bound.

de	94377
en	94378



## DVD Electropneumatics/ Electrohydraulics, Basic level

This video primarily covers electrical controllers. In addition to an introduction to electrical engineering, it shows the most important switching elements and basic circuits. Practical applications alternate with animations and circuit examples.

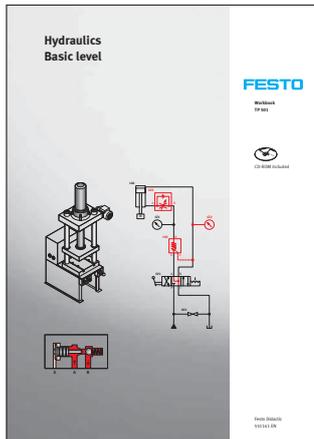
The DVD is multilingual (de, en, es, fr, it, tr, cn, ru). The language can be selected.

48 minutes

Order no. **538487**

# Hydraulics

## Workbooks



### Hydraulics, Basic level TP 501

TP 501 – Hydraulics, Basic Level is the perfect introduction to hydraulic control technology. 17 exercises help to develop knowledge of the basic physical principles of hydraulic systems, and give instructions on the function and use of hydraulic components, as well as explain the most important basic circuits. The exercises cover how to record characteristic curves, compare applications of different components, construct basic circuits and apply basic hydraulic equations. In order to carry out the exercises, students require the equipment set for TP 501 – Hydraulics, Basic Level.

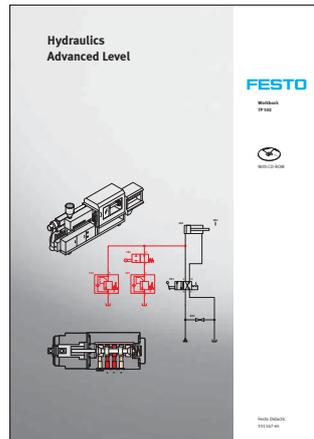
The workbook includes:

- Sample solutions
- Training notes
- Multimedia CD-ROM with graphics, photos of industrial applications, animations and FluidSIM® circuit diagrams
- Exercise sheets for trainees

Renate Aheimer, Frank Ebel  
Edition 2011, 322 pages, in colour,  
in folder.

Campus licence (→ Page 53):

de	550141
en	551141
es	551145
fr	551146



### Hydraulics, Advanced level TP 502

TP 502 – Hydraulics, Advanced Level is aimed at students who require further training in hydraulic control technology. 15 extended circuits lead students further into the complex world of hydraulics. They will learn a lot about the physical relationships and complex circuits involved in hydraulic systems. The equipment set of package TP 501 – Hydraulics, Basic Level and TP 502 – Hydraulics, Advanced Level equipment set are needed to carry out the tasks.

The workbook includes:

- Sample solutions
- Training notes
- Multimedia CD-ROM with graphics, photos of industrial applications, animations and FluidSIM® circuit diagrams
- Exercise sheets for trainees

Renate Aheimer, Frank Ebel  
Edition 2012, 264 pages, in colour,  
in folder.

Campus licence (→ Page 53):

de	550142
en	551147
es	551148
fr	551149



### Electrohydraulics, Basic level TP 601

The basic electrical circuits for hydraulic control technology are presented in 15 exercises. In order to carry out the exercises, students require the equipment set of TP 601 Electrohydraulics, Basic Level.

The workbook includes:

- Sample solutions
- Training notes
- Multimedia CD-ROM with graphics, photos of industrial applications, animations and FluidSIM® circuit diagrams
- Exercise sheets for trainees

Frank Ebel, Christine Löffler  
Edition 2011, 426 pages, in colour,  
in folder.

Campus licence (→ Page 53):

de	550143
en	551150
es	551151
fr	551152



### Electrohydraulics, Advanced level TP 602

The complex practical circuits for electrohydraulics are presented in 12 exercises. In order to carry out the exercises, students require the basic level TP 601 and advanced level TP 602 electrohydraulics equipment sets.

The workbook includes:

- Sample solutions
- Training notes
- Multimedia CD-ROM with graphics, photos of industrial applications, animations and FluidSIM® circuit diagrams
- Exercise sheets for trainees

Frank Ebel, Christine Löffler  
Edition 2012, 350 pages, in colour,  
in folder.

Campus licence (→ Page 53):

de	550144
en	551153
es	551154
fr	551155



### Proportional hydraulics, Basic level TP 701

The 10 exercises in this book provide an introduction to proportional hydraulic equipment and circuits. First the individual devices are presented and their settings tried out. Then a complete solution is developed based on a series of graduated exercises. You will need equipment set Proportional hydraulics, Basic level TP 701 to carry out the exercises.

The workbook includes:

- Sample solutions
- Training notes
- Multimedia CD-ROM with graphics, photos of industrial applications, animations and FluidSIM® circuit diagrams
- Exercise sheets for trainees

D. Scholz, A. Zimmermann  
Edition 1998, 338 pages, in folder.

Campus licence (→ Page 53):

de	94457
en	94472
es	94404
fr	94352



### Proportional hydraulics, Advanced level TP 702

The 10 exercises in this book are used to introduce the most important devices and circuits used in proportional hydraulics. You will need equipment set Proportional hydraulics, Basic level TP 701 and Advanced level TP 702 to carry out the exercises.

The workbook includes:

- Sample solutions
- Training notes
- Multimedia CD-ROM with supplementary media
- Exercise sheets for trainees

E. Bauer  
Edition 1999, 240 pages, in folder.

Campus licence (→ Page 53):

de	94458
en	94473
es	94450



### Closed-loop hydraulics, TP 511

The 21 exercises in this book are used to introduce the fundamentals of analogue closed-loop hydraulics: pressure and position control with PID controllers and position control with status controllers. You will need equipment set Closed-loop control hydraulics, TP 511 to carry out the exercises.

The workbook includes:

- Sample solutions
- Training notes
- Multimedia CD-ROM with supplementary media
- Exercise sheets for trainees

A. Zimmermann  
Edition 2000, 584 pages, in folder.

Campus licence (→ Page 53):

de	94460
en	94469
es	94368
fr	94348



### Mobile hydraulics, TP 800

The workbook contains 21 project exercises designed for equipment sets TP 801, TP 802 and TP 803 together with the corresponding exercise sheets and sample solutions. It thus provides a comprehensive course companion conveying the essential knowledge and basic principles of the hydraulic systems of mobile machines.

The workbook contains:

- Basic information
- Exercise sections comprising project exercises and sample solutions for TP 801, TP 802 and TP 803
- Training notes
- Multimedia CD-ROM with supplementary media
- Worksheets for students

L. Unan, U. Schedel, C. Löffler  
Edition 2013, 540 pages, in colour, in folder.

Campus licence (→ Page 53):

de	574165
en	574166

Reading samples at:  
[www.festo-didactic.com](http://www.festo-didactic.com)

# Hydraulics

## Set of posters

**Hydraulic symbols**

**FESTO**

**Hydraulics – Structure of a hydraulic system**

**FESTO**

**Hydraulics – Directional control and non-return valves**

**FESTO**

**Hydraulics – Flow control and pressure control valves**

**FESTO**

**Hydraulics – Energy supply and cylinders**

Substrate	Design	Stroke length	Stroke speed	Stroke force	Stroke volume
Aluminum	Standard	100, 125, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, 1000	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 120, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, 1000	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 120, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, 1000	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 120, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, 1000

**FESTO**

**Everything that you need to know: 5 posters on hydraulics**

Now the updated version of the popular A1 poster is supplied rolled up, quickly providing a comprehensive overview. All symbols and terminology correspond to the current standards ISO 1219-2 and DIN/EN 61346-2.

Subjects on the poster:

- Hydraulic symbols
- Hydraulics – Structure of a hydraulic system
- Hydraulics – Directional control and non-return valves
- Hydraulics – Flow control and pressure control valves
- Hydraulics – Energy supply and cylinders

de	196948
en	551012
es	551011
fr	551010

# Electrical engineering/Electronics

## Workbooks



### Fundamentals of direct current technology

The fundamentals of direct current technology provide an introduction to the world of electrical engineering/electronics. The content is explained and elaborated in realistic projects. The primary focus is on the explanation of the basic variables, behaviour and relationships and the recording of these using measurements.

Among the variables covered are voltage, current, resistance and conductance as well as energy and capacity. Ohm's law is explained in detail. Particular emphasis is placed on the use of measuring devices. The circuit examples include series and parallel connection, voltage divider, bridge circuit and voltage sources.

The workbook contains:

- Solutions
- Didactic notes
- Worksheets for the student
- Multimedia CD-ROM with graphics

C. Löffler

Edition 2010, 300 pages, in colour, in folder.

Campus licence (→ Page 53):

de	567207
en	567209
es	567211
fr	567213



### Fundamentals of alternating current technology

The workbook for fundamentals of AC technology continues the introduction to electrical engineering/electronics components and systems with topics relating to AC technology. The main topics covered are the electric field and induction and the resulting behaviour of components in the AC circuit.

Topics such as the capacitor and coil in the DC and AC circuit as well as the series and parallel connection of resistor, coil and capacitor are covered in project exercises. The variables of active resistance, reactance and impedance as well as the relationships between them and the topic of phase shift of current and voltage are covered in detail.

The workbook contains:

- Solutions
- Didactic notes
- Worksheets for the student
- Multimedia CD-ROM with graphics

C. Löffler

Edition 2010, 290 pages, in colour, in folder.

Campus licence (→ Page 53):

de	567215
en	567217
es	567219
fr	567221



### Fundamentals of semiconductors

The third volume of the fundamentals of electrical engineering/electronics deals with semiconductors. The design and mode of operation of modern semiconductors is covered and their application demonstrated in project exercises.

As an introduction to the topic, different diodes such as the semiconductor diode, Zener diode and LED are considered and the basic concepts are worked out. Content including PN junction, reverse voltage or conducting state current is demonstrated both theoretically and, where possible, using measurements. The topic of transistors is also explained using bipolar and unipolar transistors. The book also covers power electronics components such as diac, triac and thyristor.

The workbook contains:

- Solutions
- Didactic notes
- Worksheets for the student
- Multimedia CD-ROM with graphics

M. Wäschle

Edition 2010, 208 pages, in colour, in folder.

Campus licence (→ Page 53):

de	567281
en	567283
es	567285
fr	567287



### Basic electronics circuits

The workbook for basic electronics circuits completes the series of workbooks for the fundamentals of electrical engineering/electronics. Particular emphasis is placed on the analytical examination of the interaction between the components already covered in the first three books on the fundamentals.

The content in this case is project exercises with selected basic circuits, whereby the design is first worked out and then analysed on the basis of measurement technology. The circuits include power supply unit circuits, amplifier circuits, flip-flops and power electronics circuits as well as circuits commonly used in industrial practice.

The workbook contains:

- Solutions
- Didactic notes
- Worksheets for the student
- Multimedia CD-ROM with graphics

K.-H. Drüke

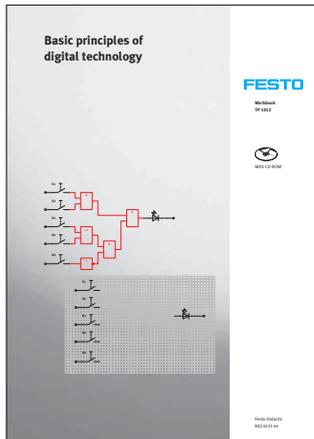
Edition 2011, 382 pages, in colour, in folder.

Campus licence (→ Page 53):

de	567289
en	567291
es	567293
fr	567295

# Electrical engineering/Electronics

## Workbooks



### Basic principles of digital technology

The basic principles of digital technology workbook provides an introduction to the world of digital signals and their interconnection. The primary focus is on the explanation of the basic variables, behaviour and relationships.

The content is project exercises with selected basic circuits, whereby the design is first worked out and then analysed on the basis of measurement technology. The contents include elementary logic modules and logic circuits, Schmitt triggers, trigger circuits, flipflops, counting circuits, data conversion and arithmetic circuits.

The workbook contains:

- Sample solutions
- Training notes
- Worksheets for learners
- Multimedia CD-ROM with graphics

S. Enderle

Edition 2012, 200 pages, in colour, in folder.

Campus licence (→ Page 53):

de	8023432
en	8023433
es	8023434
fr	8023435



### Basic principles of closed-loop control technology

The optimum introduction to the world of closed-loop systems is provided by the workbook Basic Principles of Closed-loop Systems. Using examples, the basic terms are explained and then the behaviours and relationships are focussed on. Special focus here is given to the topics of behaviour and analysis of control processes.

The basis for this are project exercises with selected basic circuits, whereby the design is first worked out and then analysed on the basis of measurement technology. Training content, among others, includes structure of a control circuit, spring responses and dynamic behaviour, Bode diagram, controlled system modelling, positive and negative feedback, two and three-step controllers as well as P, PI and PID controllers.

The workbook contains:

- Sample solutions
- Training notes
- Worksheets for learners
- Multimedia CD-ROM with graphics

C. Ament

Edition 2013, 170 pages, in colour, in folder.

Campus licence (→ Page 53):

de	8023436
en	8023437



### Power supply systems and protective measures

The workbook for power supply systems and protective measures covers the topic of the safety of electrical systems in accordance with DIN VDE in detail.

The specific conditions and the measures for avoiding dangerous situations are dealt with using realistic situations. Different types of network (TN-C, TN-CS, TT and IT network), protection against direct and indirect contact, protection against electric shock (including in the event of a fault), protection through RCD and initial and repeat testing of electrical systems and devices are explained in project form.

The workbook contains:

- Solutions
- Didactic notes
- Worksheets for the student
- Multimedia CD-ROM with graphics

J. Stumpf

Edition 2012, 230 pages, in colour, in folder.

Campus licence (→ Page 53):

de	567307
en	567309
es	567311
fr	567313



### Building automation with KNX

Modern buildings make numerous requirements of the most varying of technologies. The most important discipline here is intelligent building automation, as a modern building will not work without it.

The workbook for the basic principles of building automation introduces the relevant topics in realistic projects. Focus is on the software tools, equipment and configuration as well as their interaction and extended options.

The workbook contains:

- Sample solutions
- Training notes
- Worksheets for learners
- Multimedia CD-ROM with graphics

N. Karlsson

Edition 2013, 110 pages, in colour, in folder.

Campus licence (→ Page 53):

de	8023444
en	8023445
es	8023446



### Fundamentals of circuits with contacts

Contactor controls still have their place despite increasing automation and increasingly cost-effective control electronics. The workbook for the fundamentals of circuits with contacts covers the specific topics relating to relays and contactor controls in six realistic projects. The control circuit with topics such as self-latching loop and locking plays just as important a role here as the primary circuit with the circuits for asynchronous three-phase motors, from simple starting to star-delta reversing circuit.

The workbook contains:

- Solutions
- Didactic notes
- Worksheets for the student
- Multimedia CD-ROM with graphics

J. Stumpp  
Edition 2010, 120 pages, in colour,  
in folder.

Campus licence (→ Page 53):

de	570901
en	567315
es	567317
fr	567319



### Fundamentals of DC machines

In drive technology, DC drives currently play a major role in mobile drive solutions. The workbook for the fundamentals of DC machines covers the specific topics relating to DC drives. The content is first elaborated theoretically and then consolidated in exercises. In addition to the design of the machines, their circuitry and areas of application are demonstrated in realistic projects.

The workbook contains:

- Solutions
- Didactic notes
- Worksheets for the student
- Multimedia CD-ROM with graphics

J. Stumpp  
Edition 2011, 150 pages, in colour,  
in folder.

Campus licence (→ Page 53):

de	571781
en	571783
es	571785



### Fundamentals of AC machines

We come into contact with AC drives every day, as these motors are commonly used in household appliances and electric handheld tools in particular. The workbook for the fundamentals of AC machines introduces the topics relating to AC motors in realistic projects. Particular emphasis is placed on design, circuitry and areas of application. Control questions on the content facilitate the assessment of learning success.

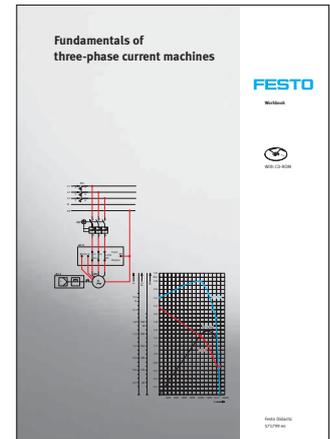
The workbook contains:

- Solutions
- Didactic notes
- Worksheets for the student
- Multimedia CD-ROM with graphics

J. Stumpp  
Edition 2011, 152 pages, in colour,  
in folder.

Campus licence (→ Page 53):

de	571789
en	571791
es	571793



### Fundamentals of three-phase current machines

The sturdy design and wide range of applications thanks to modern power electronics have contributed to three-phase motors becoming the standard drives for industrial applications. In the workbook for the fundamentals of three-phase current machines, the design, connection and areas of application are explained on the basis of realistic project exercises. The machines are exposed to a wide range of simulated load situations in order to determine their options.

The workbook contains:

- Solutions
- Didactic notes
- Worksheets for the student
- Multimedia CD-ROM with graphics

J. Stumpp  
Edition 2011, 166 pages, in colour,  
in folder.

Campus licence (→ Page 53):

de	571797
en	571799
es	571801
fr	571803

# Electrical engineering/Electronics

## Workbooks



### Fundamentals of servo motor drive technology

Servo drives play a particularly important role in automation, as they have developed into the standard drive in recent years thanks to state-of-the-art controller technology. The workbook for the fundamentals of servo motor drive technology provides a detailed introduction to the topics relating to modern servo drives in practical exercises.

The topics covered include the design and commissioning of a servo drive, RPM regulation, regulating torque and homing as well as additional content such as positioning with variable speeds, acceleration, braking and positioning tasks.

The workbook contains:

- Solutions
- Didactic notes
- Worksheets for the student
- Multimedia CD-ROM with graphics

F. Ebel, M. Pany  
Edition 2010, 192 pages, in colour,  
in folder.

Campus licence (→ Page 53):

de	571851
en	571853
es	571855
fr	571857



### Basic principles of stepper motor drive technology

The workbook for the basic principles of stepper motor drive technology provides a detailed introduction to the topics relating to modern stepper motor drives in practical exercises.

In addition to basic content including design and commissioning of stepper motor drives, practical topics such as homing, speeds, positioning, acceleration and braking ramps play an important role as well. More detailed content, for example current reduction for stepper motor drives, is also covered.

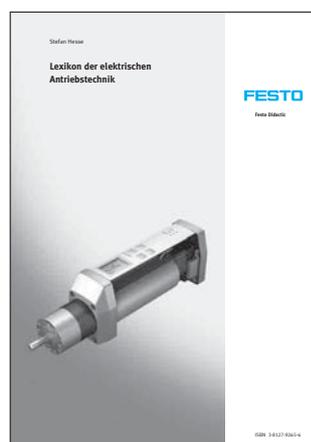
The workbook contains:

- Sample solutions
- Training notes
- Worksheets for learners
- Multimedia CD-ROM with graphics

F. Ebel, M. Pany  
Edition 2010, 194 pages, in colour,  
in folder.

Campus licence (→ Page 53):

de	571859
en	571861
es	571863



### Glossary of electrical drive technology

Modern drive technology is increasingly recognised by the bringing together of electrical and mechanical components in drive systems. New and improved drive capabilities can be achieved through the use of compact power electronics, innovative motor concepts, optimised mechanical components, new materials and high-performance communication technology. This book lists the main concepts in glossary format and provides brief explanations to facilitate a better understanding of these drives. However since there is more to an electrical drive than just the electric motor, it also touches on areas such as measurement systems, power electronics, gear units, controllers and components for transmitting power.

S. Hesse  
Edition 2004, 200 pages, bound.

de **539265**

# Electrical engineering/Electronics

## Fundamentals books

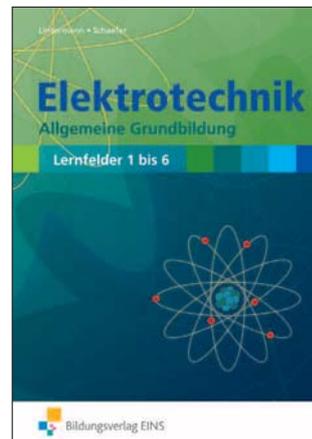


### Skills for the Electrical Industry Textbook

- Electronic engineers for operating technology, electronic engineers for power engineering and building technology, electronic engineers for automation technology
- As per current syllabus
  - Follows a thematic structure
  - Deals with all topics in the elementary and advanced level descriptively and clearly
  - Contains numerous drawings, illustrations and overviews of formulas as well as extensive review and practical exercises for each chapter
  - Covers new technologies as well as solar and wind energy
  - Includes bilingual German/English index

Rasit Özgüc, Josef Elpers, Siegfried Gairing, Norbert Meyer, Wolfgang Skornitzke, Waldemar Willner  
3rd edition 2009, 679 pages, bound

de **567297**



### Electrical Engineering Textbook

- General basic education, subject areas 1 to 6
- All the basic knowledge in a thematic and easy-to-understand approach
  - Provides a detailed explanation of the relationships between and backgrounds to the individual topics
  - Lots of examples, definitions, tables, formulas and drawings
  - Concludes each unit with an extensive set of exercises
  - Integrates English terms, brief English technical papers and a bilingual index
  - Suitable for trainees, students at technical colleges and technical assistants
  - Ideally suited as a reference book and for independent study
  - Includes a CD-ROM with additional exercises, manufacturer's documents and additional material

Franz-Josef Lintermann, Udo Schaefer  
1st edition 2009, 608 pages, bound, incl. CD-ROM

de **567298**

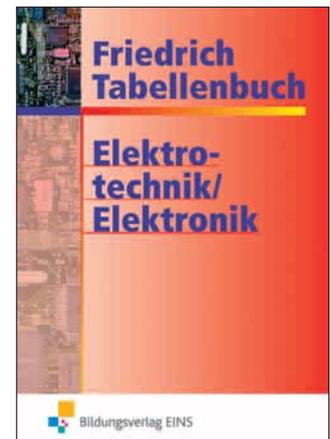
Also order:

### Electrical Engineering Solutions

- General basic education, subject areas 1 to 6

1st edition 2009, CD-ROM

de **567299**



### Friedrich Book of Tables Electrical Engineering/Electronics

- Provides a separate and detailed explanation of network configurations and computer technology
- Covers the topics of automation as well as power and supply engineering
- Matches standards and provisions to the technical texts
- Integrates numerical data and tables in explanatory texts
- Suitable for all forms of basic and further training as well as vocational practice

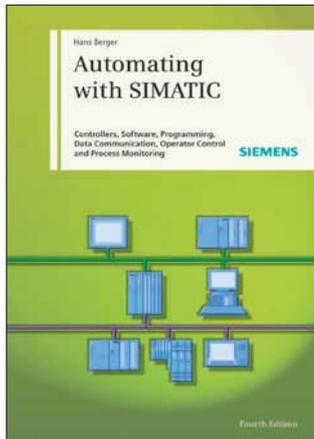
Antonius Lipsmeier, Heinz-Werner Beckmann, Kurt Lampe, Helmut Milde, Horst Rohlfing, Martin Scheurmann, Fritz Tornau, Franz-Peter Zantis

6th edition 2009, 516 pages, bound

de **567303**

# Automation technology/PLC

## Siemens technical books



### Automating with SIMATIC

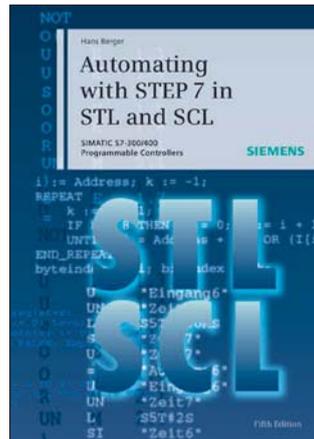
Using the SIMATIC S7 programmable logic controller as an example, this book gives the reader a comprehensive introduction to the mode of operation and structure of a modern automation system. This edition explains project planning and programming of the controller via network connection and shows the options for operating and observing the SIMATIC HMI.

The book is excellent for all readers who have little knowledge in the area and wish to learn more about programmable logic controllers.

Hans Berger

Edition 2012, 301 pages, bound.

de	194039
en	540686



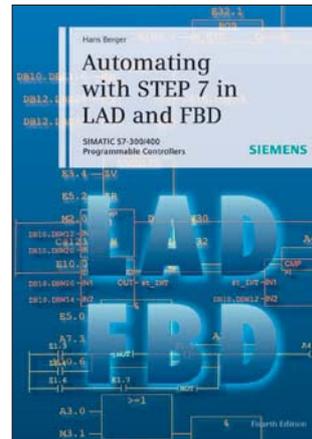
### Automation with STEP 7 in STL and SCL

The book presents the latest version of the STEP 7 basic software. This book describes the elements and applications of the text-oriented programming languages STL (Statement List) and SCL (Structured Control Language), both for the SIMATIC S7-300 and the SIMATIC S7-400, including Profinet applications. It is intended for all users of SIMATIC S7 controllers. Beginners are given an introduction to the area of programmable logic controllers, while experienced users are shown the special applications of the SIMATIC S7 automation system. All programming examples in the book – and many more – are available for download on the publisher's website.

Hans Berger

Edition 2011, 578 pages, bound.

de	194040
en	540687



### Automation with STEP 7 in LAD and FBD

The book is an introduction to the latest version of the STEP 7 programming software with functions for PROFINET IO. This book describes the elements and applications of the graphic-oriented programming languages Ladder Diagram (LDR) and Function Chart (FCH), both for the SIMATIC S7-300 and the SIMATIC S7-400 with Profinet applications. It is intended for all users of SIMATIC S7 controllers. Beginners are given an introduction to the area of programmable logic controllers, while experienced users are shown the special applications of the SIMATIC S7 automation system. All programming examples in the book – and many more – are available for download on the publisher's website.

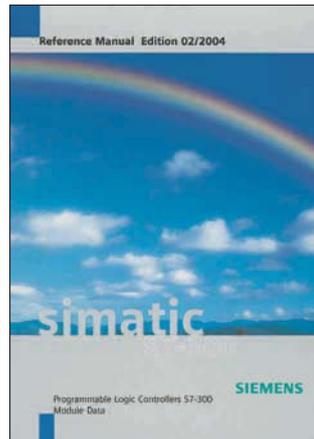
Hans Berger

Edition 2012, 475 pages, bound.

de	194041
en	540688

# Automation technology/PLC

## Siemens manuals, GRAFCET



### Manual Siemens S7-300

This documentation package comprises the following manuals:

- Setup, CPU data
- Module data
- Operations list

Edition 2003

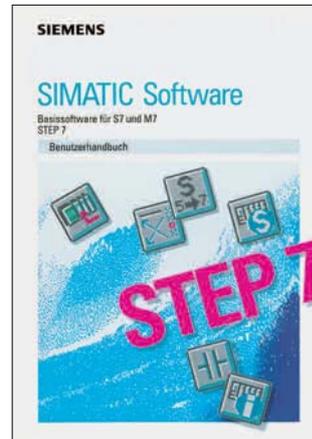
de	184557
en	184558

### Instructional material for Siemens S7, STEP 7 and Festo valve terminals

This CD contains training documents for Siemens S7/STEP 7 in the form of a PDF file. It also contains Powerpoint displays on the AS-interface, distributed automation with Siemens ET 200S and Profibus-DP as well as Festo valve terminals.

Edition 2001, CD-ROM

Order no.	528612
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### STEP 7 Fundamentals

The package comprises:

- Booklet “S7-300 simply assemble and program”
- User’s manual STEP 7
- Programming manual S7-300/400
- Converter manual

STEP 7 Fundamentals

de	184563
en	184564

STEP 7 Manual AWL, KOP, FUP (STL, LAD, FCH)

de	184565
en	184566

The package **Siemens documentation for S7/STEP 7 on DVD** contains

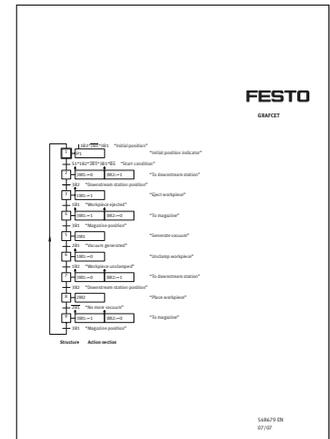
- S7-200/300/400
- C7 300/400
- STEP 7-STL/LDR/FCH/GRAPH/SCL
- SIMATIC HMI/NET/DP
- LOGO!

### System requirements

- PC with WIN 2000/XP
- DVD drive

Edition 2008, DVD

de/en/es/fr/it	192883
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### Practical knowledge: GRAFCET

The brochure describes the specification language for function charts of the GRAFCET sequence control. The contents of the DIN EN 60848 standard are described in detail. Through examples, the knowledge imparted is presented with reference to practice and greater detail is provided. Also highly suitable as a reference work.

Gerhard Schmidt

Edition 2007, 64 pages, brochure

de	548678
en	548679
es	548680
fr	548681

# Automation technology/PLC

## Dictionary, Sensors



### Dictionary of Automation Technology

Worldwide use of automation systems and their diverse areas of application have also resulted in a specialised vocabulary. Reliable translation of technical terms is an important prerequisite for successful, unambiguous communication within the framework of international collaboration.

This completely revised and expanded new edition of this dictionary now includes more than 16,700 terms, 4,500 new terms have been added.

The terms, designations and definitions included reflect the entire spectrum of industrial automation technology, from pneumatics and hydraulics, as well as electrical engineering, electronics and data processing right through to administration and training.

Edition 2008, 416 pages, bound

de – en / en – de **56975**



### Sensors for object detection 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 topics are covered by exercises using magnetic, inductive, optical and capacitive proximity sensors. Each worksheet in the book of exercises has a sample solution in the workbook.

The workbook includes:

- Sample solutions
- Training notes
- Multimedia CD-ROM with graphics, photos of industrial applications
- Exercise sheets for trainees

F. Ebel

Edition 2009, 252 pages, in colour, in folder.

Campus licence (→ Page 53):

de	<b>566919</b>
en	<b>566920</b>
es	<b>566921</b>
fr	<b>566922</b>



### Proximity sensors Textbook

This sensor textbook deals in detail with proximity sensors for handling and processing systems. The book can be used both to support basic and further training programs and for self-tuition. It is made up of a course section, a fundamentals section and a section with solutions to the exercises in the course section. The contents of the book are matched to the corresponding workbook while a glossary of keywords provides rapid access to information on particular types of sensors.

F. Ebel, S. Nestel

Edition 2003, 278 pages, bound

de	<b>93045</b>
en	<b>93046</b>
es	<b>94342</b>

# Automation technology/PLC

## Textbooks and workbooks



### Programmable logic controllers basic level

#### Textbook

This book describes the structure and mode of operation of PLCs. The central topic of the book is the DIN EN 61131-3 programming standard. This standard takes into account expansions and developments for which there was previously no standardised language. Beginners and users will find an easy-to-understand presentation of modern programming methods in accordance with the new standard for PLC programming. The solutions to the various examples are neutral and can therefore be used regardless of the PLC manufacturer.

R. Bliesener, F. Ebel, C. Löffler, H. Regber,  
E. v. Terzi, A. Winter  
Edition 2002, 214 pages, bound.

de	93310
en	93311
es	93317



### Programmable logic controllers in practice

This book illustrates possible applications of a PLC, in this case the SIMATIC S7, through practice-oriented exercises. In addition to the classical programming languages Statement List (STL), Ladder Diagram (LDR) and Function Chart (FCH), the book also contains several programming examples using the sequence language GRAPH, SCL (Structured Control Language) and HiGraph. The more complex exercises relate to the stations of Festo Didactic's Modular Production System MPS®.

Werner Braun  
Edition 2005, 355 pages, bound.

de	193449
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### Programmable logic controllers basic level

#### Workbook

This workbook covers the structure and mode of operation of a PLC and the systematic development of PLC programs. The content is based entirely on the new DIN EN 61131-3 programming standard. Practical exercises require a PLC and an actual process (can be represented using equipment set PLC, TP 301).

The workbook contains sample solutions on CD-ROM for Festo FPC 101, Siemens S7-300 and Allen Bradley SLC500. Geared to equipment set for programmable logic controllers, TP 301.

R. Bliesener, F. Ebel, C. Löffler, H. Regber,  
E. v. Terzi, A. Winter  
Edition 2002, 530 pages, in folder.

Campus licence (→ Page 53):

de	93313
en	93314
es	94427



### Fieldbus technology AS-Interface/Profibus-DP

#### Workbooks

These two workbooks impart knowledge on the application, function, configuration and programming of an AS-Interface network or a Profibus-DP network. The exercise section contains practical exercises based on components that form part of the TP 401 or TP 402 equipment list. The solution part for these exercises describes the necessary steps for configuration and programming of the solution based on Siemens STEP 7 software.

The solution programs are provided on CD-ROM. The theory part contains key information on application, mode of operation and data transmission.

The "Fieldbus technology" web-based training program is included and gives a general overview of the various fieldbus concepts as well as the application and function of the most commonly used fieldbus systems AS-Interface, Profibus-DP and Interbus. An integrated glossary explains fieldbus terms.

M. Bliesener, S. Scharf, R. C. Weber  
Edition 2003, 238/230 pages, with  
2 CD-ROMs, in folder.

Campus licence (→ Page 53):

AS-Interface de	534270
AS-Interface en	534272
Profibus-DP de	534271
Profibus-DP en	534273

# Mechatronics

## MPS® Transfer system



### MPS® Transfer System Turning Module Workbook

For mechatronics training and training in electric and metal professions.

**Topics:** Control technology, simulation and safety engineering.

**Objective:** Step-by-step teaching of basic knowledge, practice-related implementation in FluidSIM®, STEP 7 and CIROS®; independent work with internet, WBT, Mechatronics Assistant and print media.

**Contents:** The learner analyses the module function, completes parts lists, creates hardware configurations, determines I/O allocation lists, designs electric/pneumatic circuit diagrams and GRAFCET in FluidSIM®, programs sequencers in S7-GRAPH/KOP and tests programs with real and/or simulated controls and modules. The learner is familiarised with the EC machinery directive.

The workbook contains:

- Sample solutions
- Didactic instructions
- Worksheets for the learner
- Multimedia CD-ROM

A. Zabka

Edition 2010, 400 pages, in colour, in folder.

Campus licence (→ Page 53):

de	573893
en	573894



### MPS® Transfer System Measuring Module, analogue Workbook

For mechatronics training and training in electric and metal professions.

**Topics:** Control technology, simulation, analogue value processing.

**Objective:** Step-by-step teaching of basic knowledge, practice-related implementation in FluidSIM®, STEP 7 and CIROS®; independent work with internet, WBT, Mechatronics Assistant and print media.

**Contents:** The learner analyses the module function, completes parts lists, creates hardware configurations, determines I/O allocation lists, designs electric/pneumatic circuit diagrams and GRAFCET in FluidSIM®, programs sequencers in S7-GRAPH/KOP and tests programs with real and/or simulated controls and modules. The learner configures an analogue sensor and evaluates it.

The workbook contains:

- Sample solutions
- Didactic instructions
- Worksheets for the learner
- Multimedia CD-ROM

A. Zabka

Edition 2010, 360 pages, in colour, in folder.

Campus licence (→ Page 53):

de	573897
en	573898



### MPS® Transfer System Ejection Module, pneumatic Workbook

For mechatronics training and training in electric and metal professions.

**Topics:** Control technology and simulation.

**Objective:** Step-by-step teaching of basic knowledge, practice-related implementation in FluidSIM®, STEP 7 and CIROS®; independent work with internet, WBT, Mechatronics Assistant and print media.

**Contents:** The learner analyses the module function, completes parts lists, creates hardware configurations, determines I/O allocation lists, designs electric/pneumatic circuit diagrams and GRAFCET in FluidSIM®, programs sequencers in S7-GRAPH/KOP and tests programs with real and/or simulated controls and modules.

The workbook contains:

- Sample solutions
- Didactic instructions
- Worksheets for the learner
- Multimedia CD-ROM

A. Zabka

Edition 2010, 320 pages, in colour, in folder.

Campus licence (→ Page 53):

de	574135
en	574136



### MPS® Transfer System Frequency Converter MM420 Workbook

For mechatronics training and training in electric and metal professions.

**Topic:** Drive technology.

**Objective:** Step-by-step teaching of basic knowledge and practice-related implementation with the MPS® transfer line.

**Contents:** The learner is familiarised with the basic design of a frequency converter, carries out a quick set-up of the MM420, parametrises the MM420 through the BOP for reverse, normal and jog mode, adjusts boost, start-up and braking ramps, uses digital inputs and outputs for reverse, normal operation and speed shift through fixed frequencies, parametrises the MM420 for sensor-controlled start-up and braking of the MPS® transfer line.

The workbook contains:

- Sample solutions
- Didactic instructions
- Worksheets for the learner
- Multimedia CD-ROM

A. Zabka

Edition 2010, 160 pages, in colour, in folder.

Campus licence (→ Page 53):

de	574139
en	574140
fr	574142

# Mechatronics

## Training documentations



**Training documentations MPS®**  
We have put together a complete set of training documentation for MPS®.

Part A, Documentation for trainers, contains exercises and solutions related to the areas of construction, commissioning, programming, communication and troubleshooting. Additional information for the trainer is provided.

Part B, Documentation for trainees, contains solutions for the participants to work through.

The CD-ROM supplied contains both the training documentation as a PDF file as well as worked examples for the Siemens SPS S7-313C-2 DP.

### Training documentation MPS® Distribution Station

W. Eckart, Intercon-Asia  
Edition 2007, 484 pages, in folder incl. CD-ROM.

Campus licence (→ Page 53):

de	538957
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### Training documentation MPS® Sorting Station

W. Eckart, Intercon-Asia  
Edition 2007, 458 pages, in folder incl. CD-ROM.

Campus licence (→ Page 53):

de	539308
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### Training documentation MPS® Conveyor project kit

W. Eckart, Intercon-Asia  
Edition 2007, 466 pages, in folder incl. CD-ROM.

Campus licence (→ Page 53):

de	539311
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### Training documentation Process optimisation

With the basics of  
– Analysis of existing systems  
– Project plan  
– Planning and optimisation of automated systems  
– Value creation and wastage

The detailed project task, with seven subsidiary tasks based on the example of the MPS® Distribution, Inspection, Processing, Handling and Sorting stations, enables practical optimisation of a production process, with material flow analysis, devising and appraising suggestions for improvement, procurement and production of components, programming and commissioning the optimised system.

Includes a CD-ROM with circuit diagrams, symbols and sample programs for the Siemens PLC S7-300.

M. Bellenberg, T. Mehwald, H. Regber, G. Schmidt

Edition 2006, 310 pages, in folder incl. CD-ROM.

Campus licence (→ Page 53):

de	539934
en	574154
es	574155
fr	574156



### Communication-oriented approach to system malfunctions

The importance of maintenance and servicing, in particular with respect to malfunction management, cannot be underestimated in production.

The purpose of this textbook is to teach students how to reduce downtimes. Identifying failure modes, diagnosing malfunctions and fixing faults requires both specialist knowledge and interpersonal communication skills. This practical textbook addresses the situation using the case example of a medium-sized drinks bottling company: training scenarios portray realistic situations, that provide instruction in a range of faults from the simple to the cross-linked.

Includes a CD-ROM with presentations on the topic of communication and troubleshooting, circuit diagrams and function charts for the MPS® distributing and sorting stations plus the textbook.

W. E. Theuerkauf, S. Funke, G. Graube  
Edition 2006, 144 pages, in folder, incl. CD-ROM.

Campus licence (→ Page 53):

de	543068
en	574157
es	574158
fr	574159



### Training documentation “The safe system”

The training documentation entitled “The safe system” concerns itself with the safety of systems and machines, and is aligned to the new EC machinery directive. The MPS® Electrical Handling Station serves as a hardware example for the exercises. New project tasks which progress from one to the next deal with, amongst other issues, failure modes and effects analysis, performance level, common cause failure and diagnostic coverage. After completing a risk assessment for the station, other safety devices are dealt with. The basic principles of the individual topics are also included in the training documentation.

The trainee learns to work with the issue of safety at the system, and is capable of describing components and functions afterwards. Solution sheets are available to the trainer. The workbook includes a CD-ROM containing the worksheets, data sheets and solutions, as well as information on the subject of safety technology.

Jürgen Hasel, Andrea Meles  
Edition 2011, 176 pages, in colour, in folder

Campus licence (→ Page 53):

de	574143
en	574144

# Process automation

## Textbooks and workbooks



Projects for teaching the topics of **Control technology**  
Exercises, applications, simulations

A comprehensive textbook and workbook for professions in electrical engineering, metals, chemicals and mechatronics. It meets the requirements of the new learning plan and provides a practical introduction to control technology. The workbook is suitable for self-study or for classroom-based lessons. It has been completely updated, and the topic of “level control” has been added.

The combination of theory and simulation provides extra support during self-study.

Contents of the CD-ROM:

- Control simulations
- Manufacturer documents
- Further exercises
- Examples

Josef Uphaus

2nd edition 2008, 208 pages, bound, incl. CD-ROM.

de **556242**



### EduKit PA Workbook

This workbook explains the basic principles of process technology and provides an introduction to the subject. It covers manual and automated measurement, open and closed-loop control and system design topics such as planning, installation, commissioning, marketing and sales. You will be provided with exercises including all necessary worksheets as well as didactic information and solutions as support for trainers. The workbook contains detailed descriptions of the problems and parameters. The worksheets guide students through the required steps of planning, execution and function testing.

The measurement/open and closed-loop control exercises relate to flow, level and pressure technology.

The workbook includes a CD-ROM with the worksheets, data sheets and solutions.

B. Schellmann, H. Kaufmann  
Edition 2009, 430 pages, in folder, incl. CD-ROM.

Campus licence (→ Page 53):

de	<b>563969</b>
en	<b>563971</b>
es	<b>563973</b>
fr	<b>563975</b>



### MPS® PA Workbook

This workbook includes tables that allocate training aims with exercises and components with exercises, together with the fundamentals of closed-loop control technology, exercises with all necessary worksheets and didactic instructions about analysing and inspecting a system, measuring, open and closed-loop control, as well as the solutions for the instructors. The workbook provides detailed descriptions of the problem definition and parameters. The worksheets support the students through the required steps of planning, execution and function testing.

The exercises refer to the filtering, mixing, temperature maintenance and bottling processes. The trainees acquire the ability to inspect systems, to describe components and functions as well as the operation of systems.

The workbook includes a CD-ROM with the worksheets and the solutions.

J. Helmich, H. Kaufmann

Edition 2007, 430 pages, in folder, bound, incl. CD-ROM.

Campus licence (→ Page 53):

de	<b>548590</b>
en	<b>548591</b>
es	<b>548592</b>
fr	<b>548593</b>

# CNC technology/Working material

## Textbooks/Drawing templates



### CNC Textbook

Basic principles of numerically controlled machine tools (CNC). Programming in accordance with ISO and SINUMERIK 840D.

de 540692

Also order:

**Book of solutions for the sample exercises from the CNC textbook**

de 540693

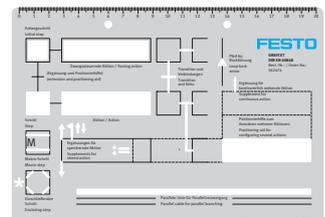


### Drawing template

The drawing templates for control technology. For fast designing of pneumatic circuit diagrams or flow diagrams. Can be used to draw all electrical (DIN 40713), electronic (DIN 40719), pneumatic, hydraulic (DIN/ISO 1219) and logic symbols (DIN 40700).

Control technology 90021

Program flow chart 90022



### GRAFCET drawing template

Drawing assistance for the simple creation of a GRAFCET plan to DIN EN 60848. All essential components such as steps, actions and transitions are available. Positioning aids support alignment of and compliance with appropriate distances. It is designed in flexible, semi-transparent plastic, is supplied in two languages and comes with a ruler.

de/en 562474

es/fr 562481

# EDS® – Environmental Discovery System

## Water Management – Workbooks

New

EDS® Water Management is a modular training system which represents the core processes of a water and wastewater treatment plant in the form of a water loop from the source to the wastewater treatment plant and back again.

All workbooks contain:

- Sample solutions
- Training notes
- Worksheets for learners
- Multimedia CD-ROM with graphics



### Water purification

After having worked through the exercises in the “Water purification” workbook, learners will be able to:

- control the basic processes of precipitation, flocculation and sedimentation
- measure the chlorine content and deal with chlorine dosage in the system
- name problems caused by too high or too low a chlorine dosage

M. Groß, C. Klippstein, P. Maurer, Y. Salazar, T. Schwab, K. Treffry-Goatley, J. Voortman, C. Wehlers  
Issue 2014, 82 pages, colour, in folder.

Campus licence (→ Page 53):

de	8028713
en	8027887



### Water supply

After having worked through the exercises in the “Water supply” workbook, learners will be able to:

- highlight special features of different pump types
- understand the influences on pump performance during water supply
- identify the interaction between pressure and flow rate in a piping system
- control water supply using different valve types
- describe the meaning of different pressure zones in a water distribution network
- detect water losses in distribution networks and highlight problems in leak detection

M. Groß, P. Maurer, Y. Salazar, T. Schwab, K. Treffry-Goatley, C. Wehlers  
Issue 2014, 138 pages, colour, in folder.

Campus licence (→ Page 53):

de	8028712
en	8027888



### Wastewater transport

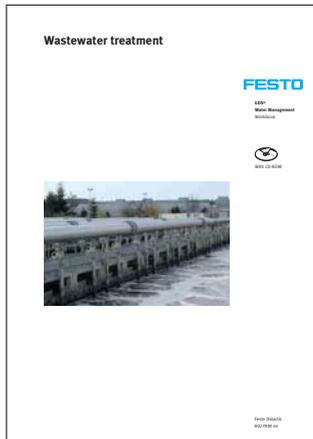
After having worked through the exercises in the “Wastewater transport” workbook, learners will be able to:

- transport solid matter in a sewer system using different flow speeds
- name the effects of exceeding the hydraulic capacity
- name the basic mechanisms that make flushing necessary
- describe the functions of a rain overflow basin
- explain the functional principle of a flow basin for solid matter retention

M. Groß, C. Klippstein, P. Maurer, Y. Salazar, T. Schwab  
Issue 2014, 82 pages, colour, in folder.

Campus licence (→ Page 53):

de	8028711
en	8027889



### Wastewater treatment

After having worked through the exercises in the “Wastewater treatment” workbook, learners will be able to:

- simulate central processes related to the sedimentation of sludge
- analyse the behaviour of floc with different flow rates and solid matter content
- name the consequences of hydraulic overload of a wastewater treatment plant
- describe the basic function of aerobic water treatment and the role of sludge recirculation
- measure the amount of dissolved oxygen and highlight the advantages of continuous measurement

M. Groß, C. Klippstein, P. Maurer, Y. Salazar, T. Schwab, K. Treffry-Goatley, J. Voortman

Issue 2014, 122 pages, colour, in folder.

Campus licence (→ Page 53):

de	8028710
en	8027890



### Monitoring, controlling and optimising operations

After having worked through the exercises in the “Monitoring, controlling and optimising operations” workbook, learners will be able to:

- control the level using a two-point controller and a linear controller
- control the flow rate using a proportional-integral controller
- understand the features of different controller types and reliably implement the controllers
- identify the impacts of different controller settings on energy consumption
- find the best control strategy for ventilation

M. Groß, Y. Salazar, T. Schwab, J. Strittmatter

Issue 2014, 110 pages, colour, in folder.

Campus licence (→ Page 53):

de	8028709
en	8027891



### Energy optimisation in water and wastewater treatment plants

After having worked through the exercises in the “Energy optimisation in water and wastewater treatment plants” workbook, learners will be able to:

- recognise the difference in energy consumption between a free and narrow piping system
- identify potential for energy savings and energy conversion in water and wastewater treatment plants
- compare different control strategies with regard to their energy requirements in order to optimise the efficiency of plant components
- calculate the costs of different control strategies
- implement energy management processes and methods

M. Groß, P. Maurer, Y. Salazar, T. Schwab, J. Strittmatter

Issue 2014, 186 pages, colour, in folder.

Campus licence (→ Page 53):

de	8028708
en	8027892

Reading samples at:  
[www.festo-didactic.com](http://www.festo-didactic.com)

## Workstation systems





<b>Universal laboratory furniture</b> .....	80
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PowerLab .....	99

# The universal laboratory furniture



## Learnline and Learntop

The modular workstation systems for basic and further training. With many practical details to make teaching and learning easier.

With **Learnline**, you have an integrated storage principle that can be used for training in pneumatic, hydraulic or electrical engineering without the need for modifications. Design and function are combined, which is evident in every practical detail. Learnline consists of basic mobile and stationary units with a cable/oil tray, various modular systems and extension elements, rolling and fixed containers, in addition to special storage systems, attachments and the corresponding accessories. The modular workstation system offers a multitude of configurations and mounting options. Expert consultants in over 50 countries are available to prepare an individual quotation for you.

**Learntop** is the least expensive worktop support system for entering the world of Festo Didactic training packages at a low price.

## Quality from Festo

We don't make compromises when it comes to quality. Workmanship and functionality are of the highest level. The torsionally rigid design and the high-quality coating of the work surface and frame guarantee a long service life despite many stresses and strains. Learnline can handle the rigorous routine of everyday teaching as well as a vibrating load during hydraulic position control. Even high mechanical forces, e.g. of servo-hydraulics, proportional pneumatics or robotic superstructures, can be easily accommodated by Learnline.

## Versatile, flexible and expandable

One glance at the basic structure proves that Learnline meets a multitude of requirements. After all, with just a few individual and well thought-out components results can be achieved which are geared towards the needs of people, the available space and to any technical challenges. The functional profile column is a prerequisite for modularity. As the central attachment point, it opens up a multitude of options for putting together each desired configuration.

All components can be placed anywhere on the slotted assembly board and can be fastened tightly and securely in the profile slot with a T-head nut or the patented Quick-Fix® without any effort and without additional tools.

A mounting system for all technologies and applications.

# Learnline and Learntop



## Keeping order

It doesn't matter whether you keep your training packages in the Systainer or in the container. The storage equipment from Festo Didactic always ensures you have a quick overview. The lockable containers are equipped with self-closing drawer runners and a safety stop. Every drawer holds up to 20 kg. The shipping packaging for the pneumatic and hydraulic equipment sets can be used as orderly drawer inserts. That saves material and gives you a quick overview of the drawer contents.

## Integrated electrics

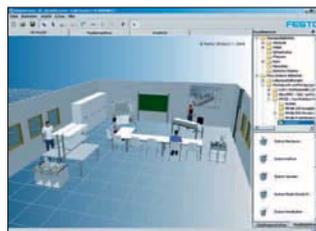
With various electrical insert panels, a supply duct and different superstructures, workstations can be put to universal use. The mounting frames can be used for a large number of assembly boards and ER units. The ER mounting frame is compatible with the electrical components of the training packages. Alternatively, you can choose an A4 mounting frame according to the electrical engineering standard.



## Standard for design and function

Learnline – Winner of international design prizes:

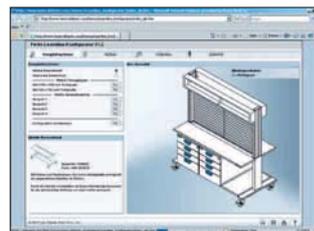
- iF product design award
- Silver Focus design award



## Planning with the LabCreator

Define rooms in 2D and design in 3D!

Use our 3D models and keep up to speed with the automatic software and library updates. Equip your laboratory with learning systems and add your own designs. You can create professional laboratories or entire training centres in just a few steps. The effects will be impressive. Detailed descriptions are available for all learning systems. Download your free LabCreator from the Internet today.



## Learnline online configurator

Familiarise yourself with Learnline's functional design and configure your workstation quickly and easily on the Internet according to your individual requirements. Opt for a predefined standard workstation or put together your own configuration according to your wishes. Slotted assembly boards, drawer units and accessories can be easily selected and added to your configuration. The result is a graphic representation of your selection with a parts list.

## Learnline mobile

More versatile than ever!



### Flexible and modular

Learnline is of modular design and offers an almost unlimited range of configuration possibilities for your Learnline workstation.

### High mobility and optimum use of space

Individual or group training workstations can be created with a minimum of effort wherever they are required. Transport through doors is also possible. This mobile workstation is designed in such a way as to permit several people to work simultaneously. This is further facilitated by the two integrated fixed drawer units that ensure quick and easy access to the required components of the Learning System.

**Learnline**  
Winner of international design prizes





**Optimum use of space**

The positioning of the storage plate means that the free space beside the fixed drawer units can be used for Systainer or other storage systems. The hydraulic power unit with single pump fits conveniently beside the 1100 mm profile plate.



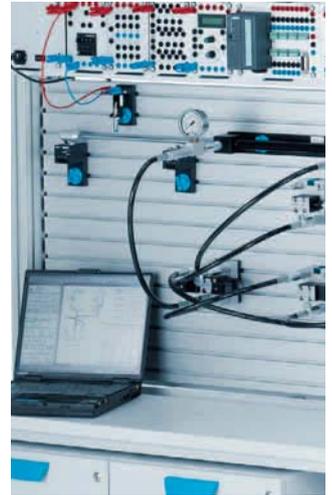
**Hydraulics for advanced trainees**

The double pump power unit fits neatly on the frame beside the fixed drawer units with no additional attachment required. The discharge measuring container also fits beside the 1100 mm profile plate.



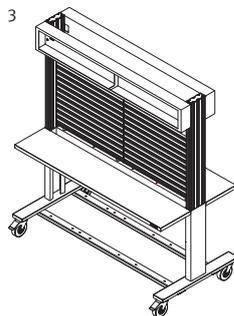
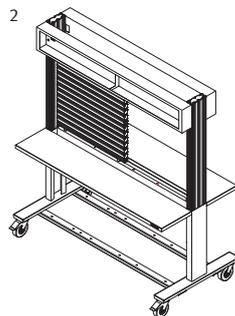
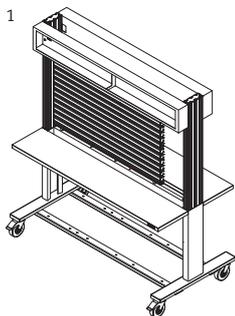
**Pneumatic and electrotechnical training**

The storage plate can hold up to two compressors. Further mounting frames for electronic components in A4 format, for example, can be used in addition to the 700 mm profile plate.



**Vertical or inclined?**

Choose the vertical profile plate if you want to use the worktop for books or laptops for example. Or if the workstation is to be used from both sides, opt for the inclination unit with an additional profile plate to adapt the plate inclination to your requirements.



The preferred types with price advantage. Flexibly expandable.

(Overall dimensions W1556 x D780 x H1773)

1 With 1100 x 700 mm profile plate and ER frame	539028
2 With 700 x 700 mm profile plate and ER frame	539030
3 With 2x 700 x 700 mm profile plate and ER frame	572155

# Stationary Learnline

## Ergonomic and flexible



### The stationary solution

With the stationary workstation systems, Learnline combines the requirements for typical desk systems with high functionality. They provide ample desk space and leg-room thanks to the roller container. The containers also ensure quick and easy access to any required components.

### Vertical or inclined?

The reliable profile plate is fastened to the stable profile of the angle adjustment. The inclination of the slotted profile plate can be infinitely adjusted, all the way down to a horizontal position. The workstation arrangement thus always offers the best ergonomic position for any exercise.

**Learnline**  
Winner of international design prizes





**Move up into another dimension:  
profile columns as set-up space**

Use the versatile profile columns as a set-up space, compatible with Quick-Fix®, for equipment sets or for attaching additional components vertically. Further components, for example cylinders with a 400 mm stroke, can be mounted on the angle adjustment profile.

**Optimum space utilisation**

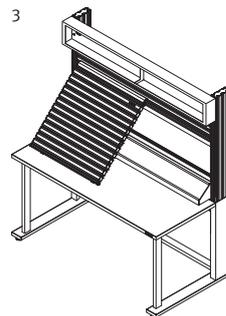
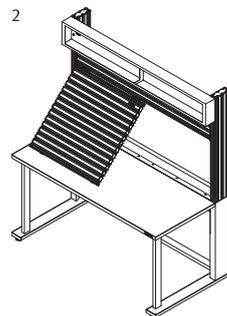
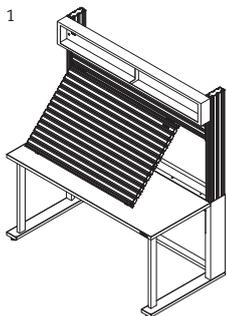
Thanks to the angle adjustment, the profile plate can be lowered into a horizontal position. Use the available space for A4 or ER mounting frames.

**Pneumatic and electrical training**

In addition to the 700 mm profile plate, additional mounting frames can be inserted for electronic components.

**Ergonomic connections**

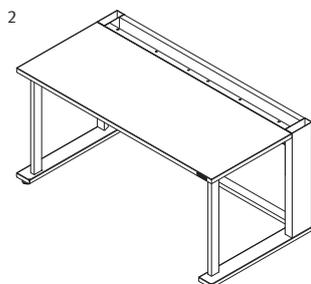
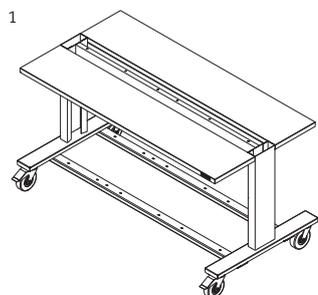
With the supply duct, you have all important interfaces within reach. Not only the electrical and pneumatic supply, but also PC interfaces, such as USB, Ethernet or serial interfaces, can be integrated in the supply duct.



The preferred types with price advantage. Flexibly expandable.  
(Overall dimensions W1512 x D780 x H1718)

1 With 1100 x 700 mm profile plate and ER frame	539023
2 With 700 x 700 mm profile plate and ER frame	539025
3 Order no. 539025 with supply duct	On request

# Your individual design



## Basic units

Stable and with a high-quality coating, the basic worktables are guaranteed to fulfil your high requirements.

### 1 Basic mobile unit

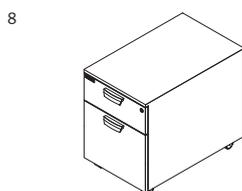
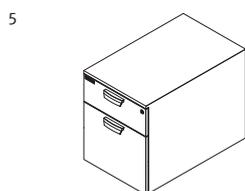
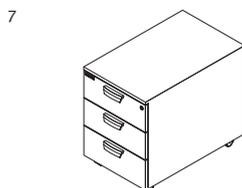
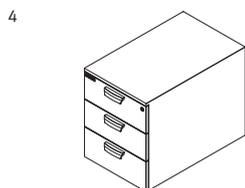
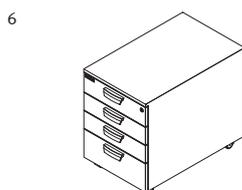
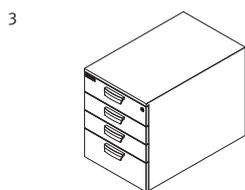
With castors and wheel brakes. The high worktop ensures a comfortable working position when standing. The flexible design of this workstation

makes it ideally suited to simultaneous use from both sides. W 1556 x D 780 x H 815.

### 2 Basic stationary unit

The height of the worktop ensures a comfortable working position when seated. With height-adjustable design and continuously variable tilting of the profiled plate. W 1512 x D 780 x H 760.

1 Basic mobile unit	535832
2 Basic stationary unit	535835



## Drawer units

### 3/4/5 Fixed drawer unit for installation in mobile workstations

Drawer unit with fully extending, lockable steel drawers with safety stop. Fronts can be labelled. Load 20 kg per drawer. External dimensions of body W 476 x D 788 x H 592, usable inner dimensions W 375 x D 700.

### 6/7/8 Wheeled drawer unit for stationary workstations

Wheeled drawer unit with fully extending, lockable steel drawers with safety stop. Fronts can be labelled. Load 20 kg per drawer. External dimensions body W 476 x D 788 x H 657, usable inner dimensions W 375 x D 700. All wheels freely movable, 2 wheels with lockable brake.

3 Fixed drawer unit for pneumatics (4 drawers)	535833
4 Fixed drawer unit for hydraulics (3 drawers)	539026
5 Fixed drawer unit for mobile hydraulics (2 drawers)	574153
6 Wheeled drawer unit for pneumatics (4 drawers)	535834
7 Wheeled drawer unit for hydraulics (3 drawers)	539731
8 Wheeled drawer unit for mobile hydraulics (2 drawers)	574152

**Mounting frame/Mounting sets**

Versatile profile columns form the core of the Learnline system. They are used to mount the profile plate frame, to attach components or as an alternative mounting surface for your training components.

**1 For vertical mounting of the profile plate**

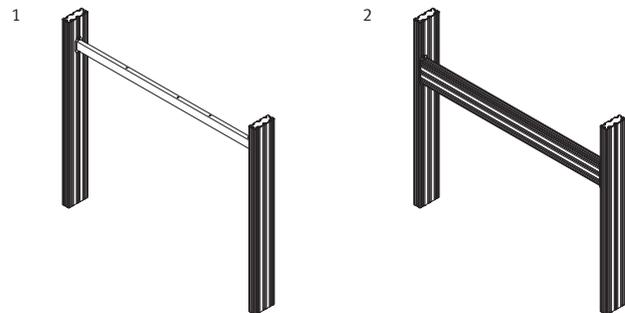
The profile plate support is mounted between the profile columns, the profile plate is securely screwed to the mounting frame and the frame structure. This makes the workstation extremely strong and resilient

and means that the profile plate can be used from both sides.

**2 For inclined mounting of the profile plate**

The profile plate support can be mounted at any height between the two profile columns, ensuring workstation ergonomics tailored to your requirements. You can also place the components from the training package directly on the mounting frame, thereby freeing up additional workspace.

Please order one mounting set per profile plate.



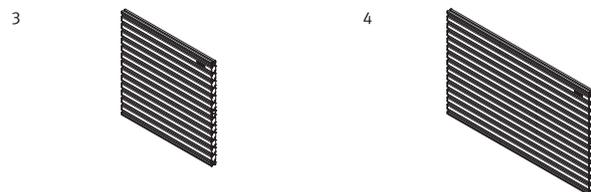
1 Mounting frame for vertical mounting of the profile plate	540698
Mounting set for vertical mounting of the profile plate	540697
2 Mounting frame for inclined mounting of the profile plate	539032
Mounting set for inclined mounting of the profile plate	539735

**3/4 Aluminium profile plates**

The anodised aluminium 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).



700 x 550 mm	159409
3 700 x 700 mm	159410
4 700 x 1100 mm	159411

**ER and DIN A4 mounting frames**

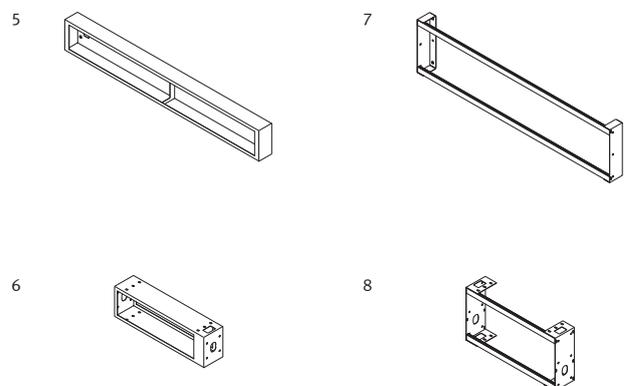
The mounting frames for the workstations are designed to hold a large number of exercise boards and ER units from the Learning System for Automation. This compatibility also extends to electrotechnical equipment in A4 format. It is thus possible to obtain a satisfactory solution to almost any specific task.

**5/7 Mounting frame (1500 mm wide)**

The frame mounted on the profile column is height-adjustable and holds up to 12 ER/6 A4 units. One mounting frame can be attached to each side of the mobile workstation.

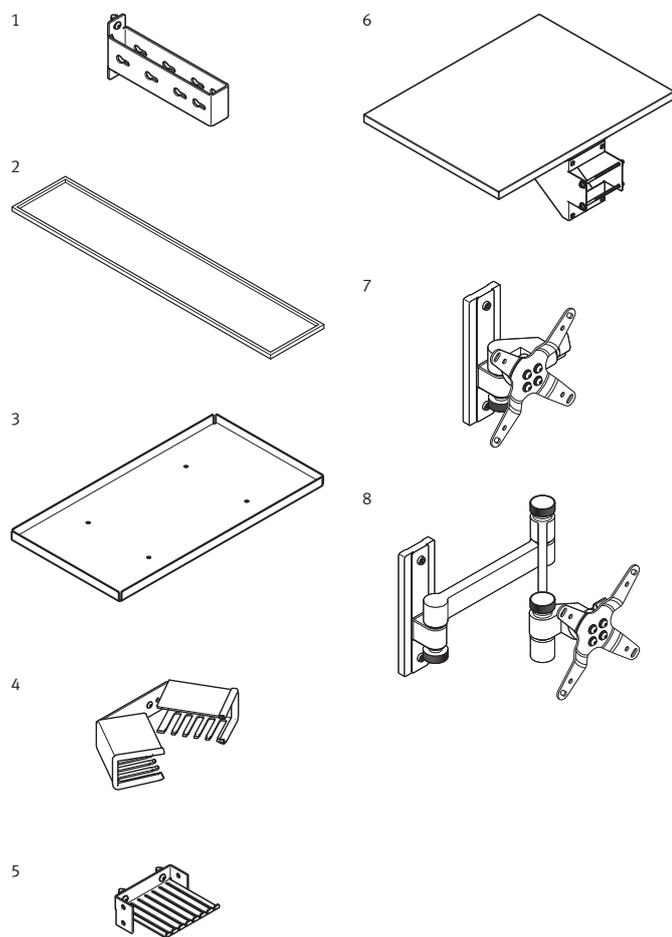
**6/8 Mounting frame (700 mm wide)**

The small mounting frame permits the use of ER/A4 components to the direct left or right of a 700 mm broad profile plate.



5 ER mounting frame (1500 mm wide)	539022
6 ER mounting frame (700 mm wide)	539033
7 A4 mounting frame (1500 mm wide)	539021
8 A4 mounting frame (700 mm wide)	539755

# Accessories



## 1 Universal bracket

Permits the mounting of up to 2 hydraulic power units with single pump, up to 2 hydraulic measuring containers or holders for storing hoses.

W 50 x D 275 x H 130.

Order no. **539736**

## 2 Oil spillage/protective mat

Black, with rubber border. Protects the tabletop of the Learnline system and keeps it clean.

312 x 1512 mm **541133**

## 3 Storage plate

Fits into the mobile frame in addition to 2 drawer units and offers installation space for 2 compressors (order no. 91030) for example.

W 748 x D 403 x H 30.

Order no. **539729**

## 4 Hose holder

For up to 20 hydraulic hoses. Provides neat storage and protects hose couplings from ingress of dirt.

W 366 x D 182 x H 80.

Order no. **539737**

## 5 Cable guide

For a set of laboratory cables.

Ensures that cables are kept neatly and in order.

W 150 x D 136 x H 63.

Order no. **535812**

## 6 Table extension

For easy attachment to the profile column of a mobile workstation. The height of the table can be adjusted to between 700 and 815 mm.

The tabletop dimensions are

W 780 x D 600.

Order no. **566435**

## 7 Monitor bracket, short

Monitor bracket for TFT and LCD monitors with drill holes in accordance with the VESA standard (distance between holes 75 x 75 mm or 100 x 100 mm).

– Short swivel arm for minimum distance to the mounting surface (approx. 8 cm)

– For mounting on Learnline mounting frames or fastening to a wall

– Rotatable up to 180°, tiltable up to 45°

– Supplied complete with mounting material

– Maximum load capacity 23 kg

Order no. **556292**

## 8 Monitor bracket, long

Monitor bracket for TFT and LCD monitors with drill holes in accordance with the VESA standard (distance between holes 75 x 75 mm or 100 x 100 mm)

– Long telescopic articulated arm for a large swivel angle

– Distance from mounting surface (approx. 8 – 38 cm)

– For mounting on Learnline mounting frames or fastening to a wall

– Rotatable up to 180°, tiltable up to 45°

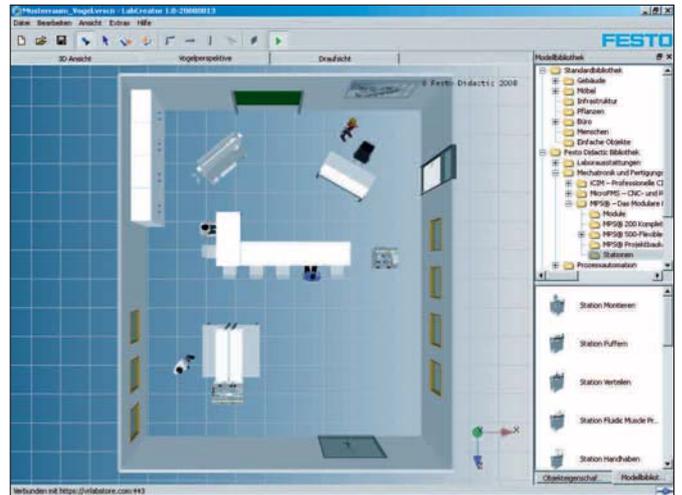
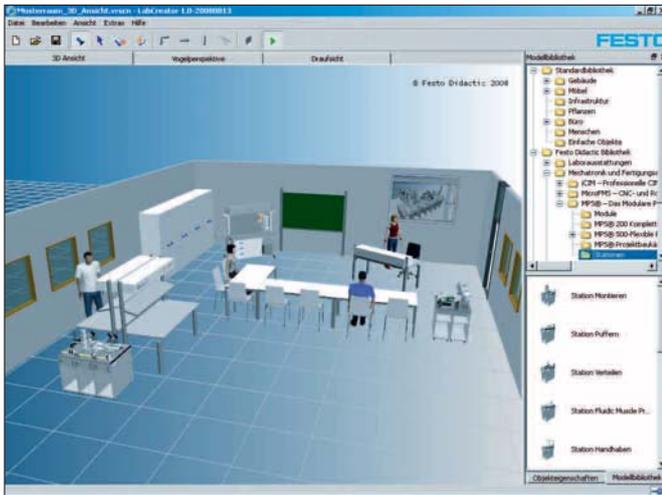
– Supplied complete with mounting material

– Maximum load capacity 15 kg

Order no. **556293**

# LabCreator

## The professional design programme for laboratories



### LabCreator The professional design programme for laboratories

Create professional layouts and individually equipped laboratories for basic and further training in just a few easy steps.

The laboratories can be equipped with Festo Didactic model products or you can create your own personal designs and 3D models.

With automatic software and library updates, you'll always be at the cutting edge.

In German, English, Spanish and French. Includes a detailed help function.

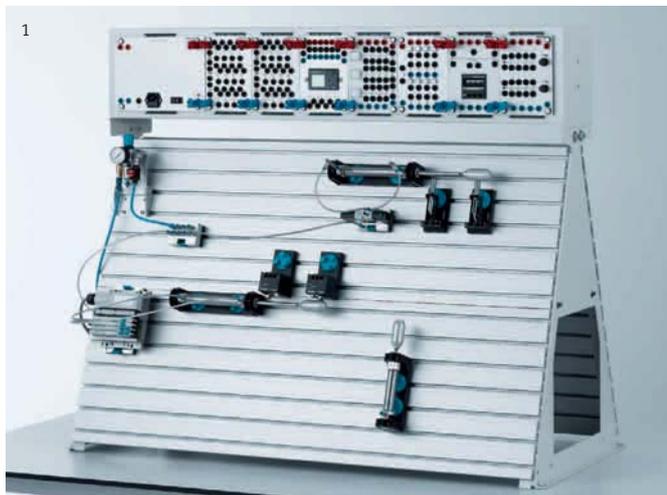
**Download now for free!**

### The benefits to you

- Create plans and layouts quickly and simply thanks to intuitive prompting. The integrated help function offers additional guidance.
- LabCreator generates rooms to scale; the walls are full-size and can be fitted with windows and doors to help you avoid planning errors.
- Switch between 2D layout and 3D view. Move the observation point around the room to get a realistic impression of the design progress.
- Extensive model library with partially animated learning systems, equipment, infrastructure and model people. This means that, for example, robot stations can be animated, giving a more lifelike impression of the laboratory.
- Adaptable to new equipment and fully customisable. Drag and drop to import VRML files into the design and create your own 3D models.
- Worldwide platform for exchanging models. The integrated LabCreator server and online library provide you with immediate access to models designed by other LabCreator users.
- Use textures to give your models a realistic look.
- Use the flight recorder to create automatic tours which show your laboratory from a number of different viewpoints. Export the finished "flight" as a video to complement a presentation of your ideas.
- Export the laboratory design as a VRML, PDF or one of many picture formats.
- Generate a complete proposal for equipping your laboratory at the click of a mouse.
- The finished laboratory is saved in XML-Format. These files are very small and can easily be sent by email to other users.
- Detailed information on all the Festo products you need for your laboratory.

# Learntop

## The low-cost desktop mounting system



The low-cost introduction to the world of training packages from Festo Didactic: Enjoy the advantages of the profile plate and the ER mounting frame when carrying out your pneumatic, hydraulic, sensor or PLC training. The devices can be clearly arranged and ensure an ergonomic working position at your existing work tables and benches.

Mounting parts and instructions for mounting the profile plates are included. It is recommended that Learntop be fastened to the table for security reasons.

### 1 Learntop-S

The versatile equipment holder for all technologies.

- Mobile: Can be simply set up on an existing work table/bench.
- Versatile: Can be used from both sides.
- Ergonomic: The angled profile plate enables components to be easily assembled.
- Dimensions (W x H x D): 1100 x 510 x 943 mm

Accepts up to 4 profile plates of size 350 x 1100 mm (order no. 162360) or 2 profile plates 700 x 1100 mm (order no. 159411).

Profile plates not included.

Order no. **540668**



### 2 Learntop-A

Equipment holder for use on one side of the workstation. Ergonomic arrangement of components thanks to the inclined profile plate. Not suitable for hydraulic training.

Can hold up to 2 profile plates of size 350 x 1100 mm (order no. 162360) or one profile plate of size 700 x 1100 mm (order no. 159411).

Profile plates not included.

Order no. **540670**



### 3 Learntop-L

Equipment holder for use on one side of a workstation; for profile plates of size 700 x 1100 mm (order no. 159411). For horizontal profile plate configurations. Not suitable for hydraulic training.

Profile plates not included.

Order no. **540669**

# Accessories

## 1 Aluminium profile plate

The anodised aluminium 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).

Size 350 x 1100 mm supplied without side caps (H x W).

350 x 1100 mm	162360
700 x 1100 mm	159411

## 2 Cable guide

For a set of laboratory cables. Ensures that cables are kept neatly and in order. W 150 x D 136 x H 63.

Order no.	535812
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## 3 Hose holder

For up to 20 hydraulic hoses. Provides neat storage and protects hose couplings from ingress of dirt. W 366 x D 182 x H 80.

Order no.	539737
-----------	--------

## 4 Oil drip tray for Learntop-S workstation

Dimensions: 1160 x 760 mm

Order no.	357283
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## 5 Mounting kit for hydraulic cylinder with weight

To be mounted on Learnline with a vertical or horizontal profile plate (alternatively for mounting on the Learnline profile column) or Learntop-S with an inclined profile plate. With this mounting kit, the pulling and pushing load of the basic hydraulics packages, which comprise the cylinder (order no. 152857) and weight (order no. 152972), can be achieved. The cover (order no. 152973) must be used for safety reasons.

Learntop-S, inclined profile plate

Order no.	526847
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Learnline, vertical profile plate

Order no.	533528
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Learnline, horizontal profile plate

Order no.	119352
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## 6 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. (overall dimensions B x H)

694 x 297 mm	159331
700 x 550 mm	544246

## 7 Rubber feet

For non-slip, protective mounting of profile plates on tabletops of any type. Set (4 pieces).

Order no.	158343
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## 8 Plug-in adapter set

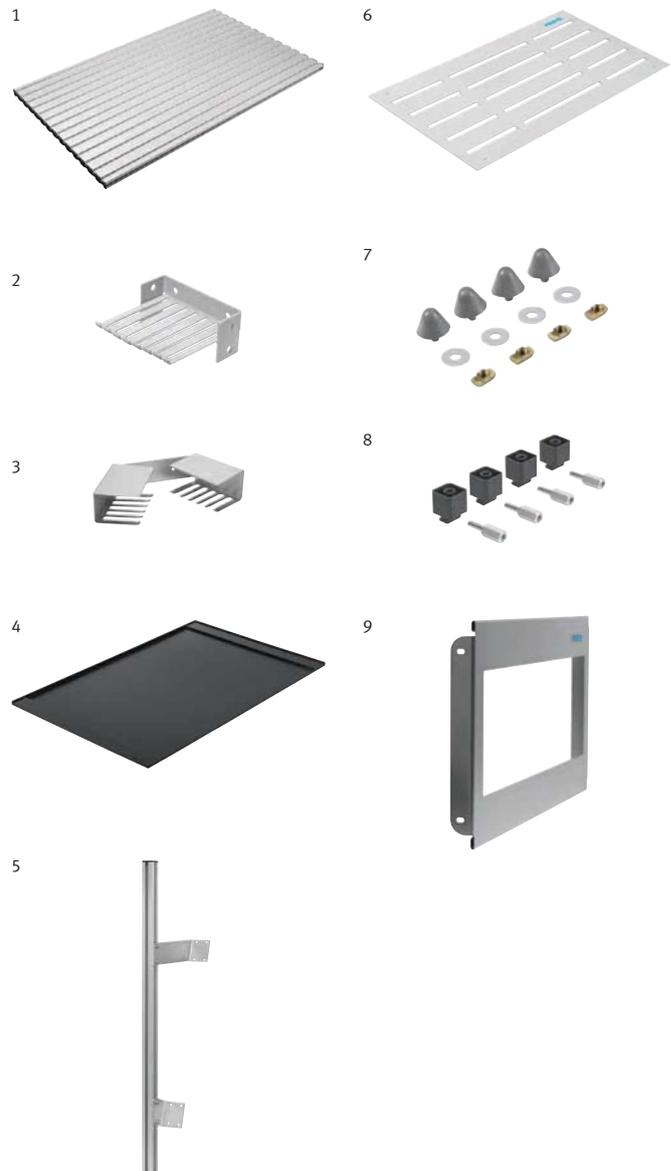
The plug-in adapter set can be used to mount the ER units directly on the blue plug-in board or on the aluminium profile plate. One set is required to mount one unit.

Order no.	541122
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## 9 A4 ER mounting frame

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
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# Laboratory furniture for electrical engineering



## Professional laboratory equipment

Intelligent and innovative laboratory solutions for electrical engineering – from single workstations to complete laboratories.

Together with our partner Haid KG, we are developing the **Swing** laboratory furniture series. Haid KG specialises in consulting, developing, planning and producing equipment for electronic and electrical engineering, laboratory furniture systems for research and training, as well as ergonomically designed laboratory and assembly workstations.

Choose from a multitude of matching modular workstations, intelligent and reliable solutions for power supply, device technology, cabinet systems and all the necessary high-quality accessories. It goes without saying that all products have been tested for safety.



Festo Didactic is the sole supplier of Haid KG products on the didactic market. We are happy to assist you with planning, selecting and sizing your workstation or laboratory.



## Swing table substructures

A wide spectrum of workbench substructures form part of the Swing program. Under-workbench units and roller containers with drawers in various depths, either with or without pull-out shelf, form the basic equipment. It is also available in ESD version, installations for electronic and electrical engineering. We offer special floor units for PCs.

## Swing, Basic and cabinet systems



### Swing profile columns

The Swing profile solution optimally meets all demands in terms of visual appearance, functionality as well as both flexibility and modularity. The cable duct integrated into the profile facilitates the concealed laying of cables and compressed air supply lines. The cable duct and any unused connection elements are sealed with cover profiles to keep them clean. Levelling screws in all table legs round off the overall concept.



### The floating tabletop

The Swing profile and the worktop are connected via delicate yet stable connecting components, making the entire system transparent. Swing add-on workbenches are connected to the basic workbench. The height-adjustable worktops lock into one another seamlessly and are all supported by the legs in the centre.



**Basic** is the functional, inexpensive laboratory equipment system for electrical engineering, with solid worktop supports made of powder-coated steel tubes. It consists of workbenches in six different widths and three depths.



In addition, you can completely equip your laboratory space with **multimedia workstations** and **cabinet systems**.



# Swing

## Configuration example



### Versatility for your individual needs

Swing stands for the unlimited possibilities for individual training laboratory design. Workbenches are created from a few basic components in nearly all thinkable dimensions. Three depths and six widths as well as various working heights are provided for by the standard construction kit. Whether 19" top elements, mounting frames for experimentation plates or perforated metal grid – we will deliver the right solution.

### Intelligent solutions

The Swing system already offers fully integrated vertical and horizontal cable conduits as a standard feature. The cable duct in the Swing system profile permits a comfortable vertical cable guide. The basic equipment also includes cable connections which are mounted in a concealed position on the rear cross frame.



#### Supply duct with electrical system, compressed air and communication

The aluminium supply duct can be made to various lengths, depending on requirements. The various mounting options, such as directly on the workbench or raised up as a cockpit, make for a tidy work surface. All frequently required interfaces can be optimally arranged to be within reach.

Choose from insert panels, such as safety and switching elements for AC current (230 V or 400 V) with key actuators, indicator lamps, motor protection switches, fault current circuit breakers or emergency stop buttons. Depending on the application, you can equip the duct with CEE or earthing contact sockets or safety sockets for three-phase current, direct current or alternating current. Integrate a compressed air outlet via various one-touch fittings.

The most important PC interfaces, such as USB, RS232 or Ethernet can also be integrated in the supply duct. This enables the PC to be connected quickly and ergonomically to various control components.



#### Worktop components and cockpits with laboratory devices

Alternatively to the supply channel, worktop elements and cockpits in 3 or 6 RU can be integrated. Raised structures are visually elegant and offer optimal utilisation of the worktop. Based on a modular basic grid, each workstation can be individually equipped. Changes, modifications or subsequent extensions can be made at any time.

We offer numerous devices such as infinitely variable voltage devices, lab power supply units, three-phase supplies, fixed voltage devices, adjustable isolating transformers for AC/DC and three-phase current, devices for test engineering and also compressed air supplies.

Variable equipment with 19" segments in cassette design or as insert panels is available, according to your wishes and requirements. It goes without saying that all insert panels for power supply and communication can also be integrated.

# Swing

## Flexible solutions, configuration examples



### Swing – mobile dual work station

Particularly flexible and versatile.

The mobile dual work station Swing (W 1250 x D 800 x H 1850 mm) is perfectly suited for presenting the introductory seminar on installation technology and EIB, as well as for conducting all other tests which require you to stand.

The rollable basic frame can be individually equipped with or without:

- Storage area
- Floor cabinet
- Perforated sheets
- Aluminium profile plate
- A4 mounting frame: 1-, 2- or 3-row
- Monitor bracket
- PC bracket
- Cable receptacle
- Socket strip

Further available options include power ducts with integrated transformers, power supply units or PC interfaces.

The dimensions (H x W x D) can be customised on request.

It is even possible to purchase a compatible “garage”. The trolley can be easily stored in the designated space in the wall cabinet. Close the door and the laboratory has been tidied away.



### Swing – demo trolley

Custom design your ideal demonstration trolley.

You can choose from the following furniture modules:

- Floor cabinets
- PC bracket
- Monitor bracket
- A4 mounting frames
- Cable holder
- Top cabinets incorporating the entire width of our 19” modules

The grooved mats enable clean and easy storage of the A4 plates in the floor cabinets. The single, double or triple row A4 mounting frame, positioned above the worktop, provides sufficient space for using the plates.

A convenient and reliable solution for PC storage can be found in the floor cabinet equipped with ventilation grid and cable openings. Heavy duty extensions for motors can be integrated behind the revolving doors.

A top cabinet or power ducts can be placed on the working surface (1360 x 675 mm) on request.

In terms of the demo trolley’s dimensions, we will happily take individual requirements into consideration. Nothing stands in the way of the perfect solution!



#### Swing – swivel table

Would you like to make the most of the laboratory's size?

No problem. The Swing swivel table is an electric workstation and lesson table in one. The same workstation can be used to conduct electrotechnical tests in the morning and give theoretical lessons in the afternoon. At the press of a button, the superstructure is lowered out of sight in a matter of seconds. This provides immediate access to the entire working surface. And all of the equipment is protected.

All equipment, PC interfaces and power supplies can be integrated in the superstructure.

The tables are available in all standard sizes.

Widths:

- 1200 mm
- 1600 mm
- 1800 mm
- 2000 mm

Depths:

- 800 mm
- 900 mm
- 1000 mm

The manufacture of custom size tables is always possible.



#### Swing – lifting platform

The right solution for every purpose.

The Swing lifting platform always consists of the lifting unit and a table of your choice, which is positioned in front of the lifting unit. In this case, it really is possible to store everything away. The professional double stroke technology even allows extremely heavy top cabinets to completely disappear below the worktop. From device technology and power supply equipment, through to monitors or laptops and even A4 mounting frames. Anything is possible!

To list a few examples, you can choose from:

- Fixed voltages
- Controllable power supply units
- Controllable transformers
- USB interfaces
- Sub-D sockets
- Ethernet sockets
- Compressed air couplings
- Plug sockets
- Safety sockets
- Soldering stations
- Test equipment

Power transformers or high-tension test devices also fit in the six available vertical height units (6 HU).

The height of the electrically-driven top cabinet is infinitely adjustable. Only the equipment required at any one time is visible, while the rest is protected.

Safety is the highest priority. When lowering the top cabinet, fingers are protected from injury by the folding anti-pinch guard.

# Basic and cabinet systems

## Functional diversity for your labs



### Basic – the functional lab equipment system for electrical engineering

A functional equipment system with solid workstation frames made from powder-coated steel tubes forms the basis of the Basic product family.

It consists of workbenches in six different widths and three depths. The design is so rigid that it can also support heavy superstructures. Both raised supply bridges and equipment placed directly on the workbench are possible with this system. Furthermore, superstructures can be used as partitions or extremely flat cassette tops.

Our under-bench units and roller containers provide plenty of storage space and make for a tidy workstation. Various depths and drawer configurations leave nothing to be desired.

And EDP isn't missed out either. Special under-bench units for computers and printers, pull-out keyboard shelves and PC racks are among the wide selection.



### Multimedia workstations

Various designs for attractive multimedia workstations are available: PC desks with sliding slides, cable ducts, cable guides, linking elements, PC racks, substructures or socket strips. Furthermore, diverse workstations and furniture for teaching theory are available: C-shape tables, four-legged tables, mobile table frames, laptop trolleys, swivel chairs, skid base chairs, four-legged chairs, tables, flip charts, projection screens. All with integrated design, reliable high quality and functionally sound, made in Germany!

Ask us and we will help you find the perfect solution.



### Cabinet systems

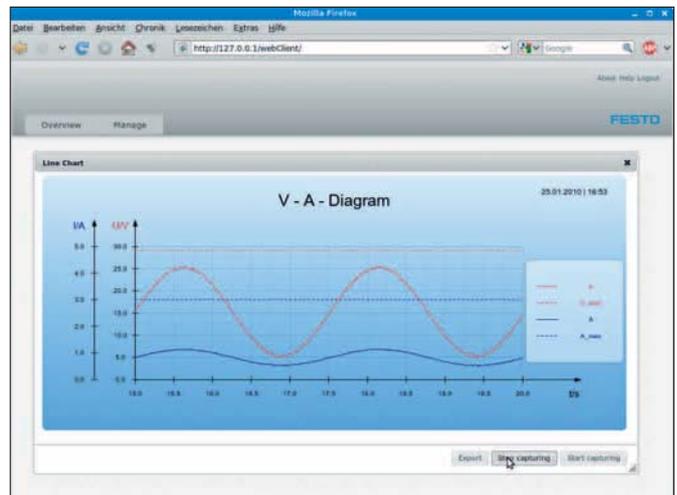
We offer an extensive range of cabinets, harmonised with the design of our workstation systems. Based on a simple framework, various tall cabinets, medium-high cabinets, storage cabinets, tall corner cabinets and top cabinets are available to choose from. The modular system offers maximum possible combinations and optimal design flexibility with an attractive price/performance ratio.

Shelf inserts with grooved mats for orderly storage of experimentation plates are just as much part of the range as strengthened lower shelves. We supply spacious shelf inserts specially for ESD cabinets. Be it cabinet layout, duct systems or various locking systems – we offer the right solution.

And if you have any other special wishes, we will be happy to manufacture to meet your exact requirements.

# PowerLab light

# PowerLab



PowerLab light is the web-based solution for device management in electric labs.

For pure switching and monitoring functions, PowerLab light provides an industrial touch panel in the teacher's desk with the following functions (see figure):

### Display of classroom status

- Release of voltage level up to 60 V
- Release of voltage level up to 230 V
- Release of voltage level up to 400 V (option)
- Display of the emergency stop status
- Raising/lowering the lifting platform
- Setting/starting the timer
- Up to 16 lab tables can be controlled
- Table grouping (4 groups)

### Mobile operation using pads and tablets

Thanks to web technology, the functions of PowerLab light can be used simply by using an HTML5-capable browser on most pads and tablets – no special apps required. Mobile operation is possible in parallel with the touch panel integrated in the teacher's desk. When inquiring, please indicate whether you would like to use this function. A WLAN access point must then be planned.

Order no. **C05502**

PowerLab is the web-based software for device management of electric labs.

No special software is needed to use PowerLab on the teacher's PC; only a HTML5-compatible browser is required.

The most important functions:

### Measurement curves

Voltage and current flows can be dynamically depicted in measurement curves. In this way, the relationship between current and voltage is displayed graphically on the PC without any additional auxiliary means.

### Trace function

Events or continuous values can be recorded and archived in a file. The type of events or values to be recorded and the scanning frequency are set by the user through a configuration page.

### Remote control

PowerLab has read access to the power supply at all times and can depict the current values and limits. In the remote control mode, both the limits and the set values can be changes from the teacher's PC.

### Room management

The placement of devices in the room is clearly graphically depicted. In this view, alarms are depicted in compressed form on the affected laboratory table.

### Profiles

Several profile files can be assigned to each laboratory room. As a result, all devices in a laboratory room can be parametrised for a new situation with a click of the mouse (e.g. instructional year 1, instructional year 2, instructional year 3).

### Communication

Communication of the devices runs standard over the Ethernet. As a result, the infrastructure already in the laboratory is used. Each device uses its own IP address, which is determined together with your IT administrator.

PowerLab Server

Order no. **C05501**

Driver (per device type)

Order no. **C05500**

# Pneumatics training packages





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# Pneumatics training packages

Innovative and practical, right down to the smallest details



## 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 specialised 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 frame and sequenced individually. The profile slots on the workstations are the same for all pneumatic, hydraulic and electrical units – a single investment, with double the 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 it – power!

No compromise on safety: all electrical components and units are connected with 4 mm safety sockets or safety plugs. The pneumatic power is supplied by the connection of highly flexible plastic tubing to the Quick Star (QS) push-in fitting. The system therefore requires virtually no consumables or tools.



**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 further 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®
- Practical implementation with the training packages and the exercises in the workbooks
- Functional testing and optimisation 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" or the new "Vacuum technology TP 230".



**TP 230 Vacuum technology**

Handling workpieces with suction grippers has become an indispensable part of handling technology. It offers advantages such as the simple configuration of suction grippers and gentle handling of workpieces while also enabling rapid cycle times, and the capital outlay required is comparatively low. The training package TP 230 expands the contents of TP 201 to include the key area of vacuum technology.

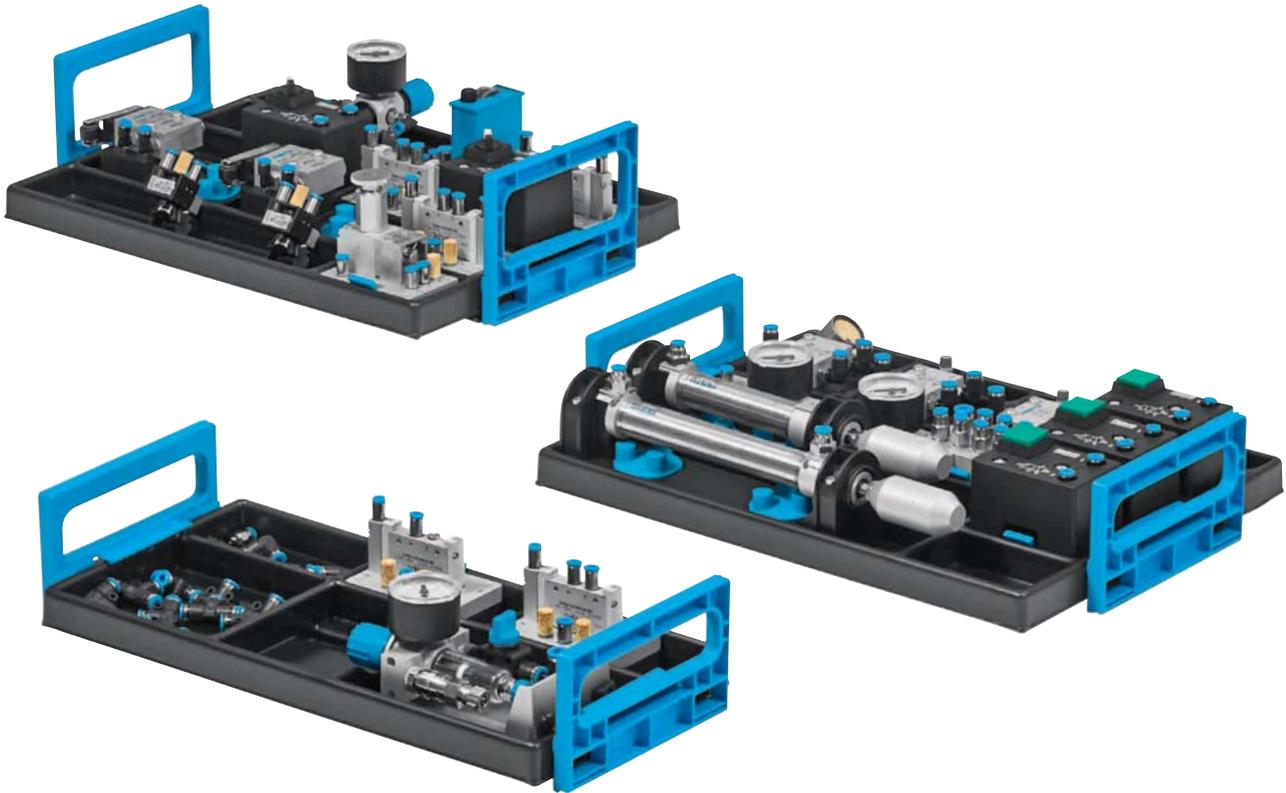


**TP 250 Safety in pneumatic systems**

Function, efficiency and above all safety determine the success of plant machinery and automated systems. New directives and laws require intelligent solutions and raise the level of professional skills required. The systematic optimisation of a simple pneumatic system helps to identify hazards in pneumatic processes. The appropriate actions to reduce the risk can be implemented in a professional manner.

# Equipment set TP 101 – Basic level

## Basic pneumatics training



### Pneumatics, Basic level – The fully revised classic

Further enhanced and updated through the lessons learned from over 1,000 seminars on pneumatics.

- With brand-new industrial components, enabling you to teach tomorrow's industrial standard today.
- The workbook contains a series of graduated project exercises based on actual industrial applications, an enhanced section on fundamentals and a multimedia CD-ROM.

The number of components and the design are specially tailored to the projects contained in the workbook so that the main fundamentals can be imparted with little outlay. Delivered in practical, Systainer-compatible equipment trays.

### Training aims

- Structure, function and application of single-acting and double-acting cylinders
- Calculating basic parameters
- Direct and indirect actuation
- Application and function of 3/2 and 5/2-way valves
- Methods of actuation of directional control valves
- Analysing circuits
- Options for pressure measurement
- Pressure-dependent control systems
- Distinguishing flow control methods and using them as intended
- Explaining and building latching circuits
- Logic operations: explaining and implementing AND/OR/NOT operations
- Combining logic operations
- Function and application of limit switches
- Time delay valves
- Realising oscillating movement
- Economic considerations of using pneumatic components

### Performance through close proximity

Switches and valves should be mounted as close to the actuator as possible for optimum performance. You can now apply the same principle when designing your circuits thanks to the new components. Furthermore, this approach also provides you with an easy way of demonstrating the performance of a one-way flow control valve. You can even record the measured values and analyse the results, for example using the TP 210!

### The next generation of valves

The new generation of valves allows the operation of various pressure zones – so nothing stands in the way of an efficient use of energy. In addition, the position of connection was optimised so that differences between the circuit symbol and the valve can be avoided.

### Pneumatic timer

The pneumatic timer can be precisely adjusted and is easy to read. Pressure changes do not alter the set delay time. Pneumatics at its best.

**Complete equipment set TP 101 in equipment tray 540710**

The most important components at a glance:

1	2x 3/2-way valve with pushbutton actuator, normally closed	152860
2	1x 3/2-way valve with pushbutton actuator, normally open	152861
3	1x 5/2-way valve with selector switch	152862
4	1x 3/2-way valve with selector switch, normally closed	152863
5	2x 3/2-way roller lever valve, normally closed	152866
6	2x Proximity sensor, pneumatic, with cylinder attachment	2764815
7	1x Pneumatic timer, normally closed	540694
8	1x Pressure sequence valve	152884
9	1x 3/2-way valve, pneumatically actuated at one end	576302
10	1x 5/2-way valve, pneumatically actuated at one end	576307
11	3x 5/2-way double pilot valve, pneumatically actuated at both ends	576303
12	1x Shuttle valve (OR)	539771
13	2x Dual-pressure valve (AND)	539770
14	1x Quick-exhaust valve	539772
15	2x One-way flow control valve	193967
16	1x Single-acting cylinder	152887
17	1x Double-acting cylinder	152888
18	1x Start-up valve with filter control valve	540691
19	1x Pressure regulator valve with gauge	539756
20	2x Pressure gauge	152865
21	1x Manifold	152896
22	2x Plastic tubing, 4 x 0.75 silver 10 m	151496

Accessories, also order:

Aluminium profile plate → Page 238

Compressor → Page 240

Also order:

**Workbook**



Nineteen project-orientated exercises, increasing in complexity and suitable for equipment set TP 101, are the ideal introduction to pneumatics. Real problem descriptions with positional sketch, concrete project tasks and detailed aids for professional implementation provide the ideal preparation for the real-life industrial environment.

The workbook includes:

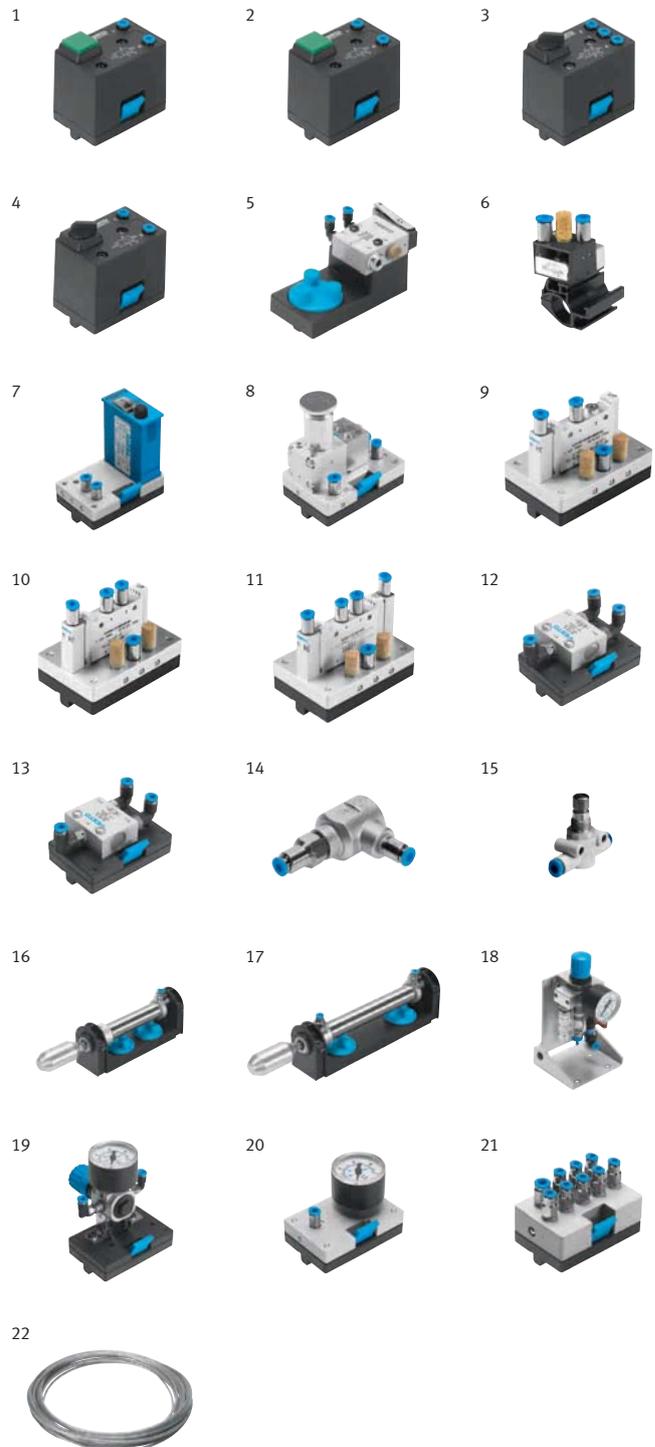
- Sample solutions
- Training notes
- Multimedia CD-ROM with graphics, photos of industrial applications, animations and FluidSIM® circuit diagrams
- Exercise sheets for trainees

Campus licence (→ Page 53):

de	540671
en	541088
es	542503
fr	542507

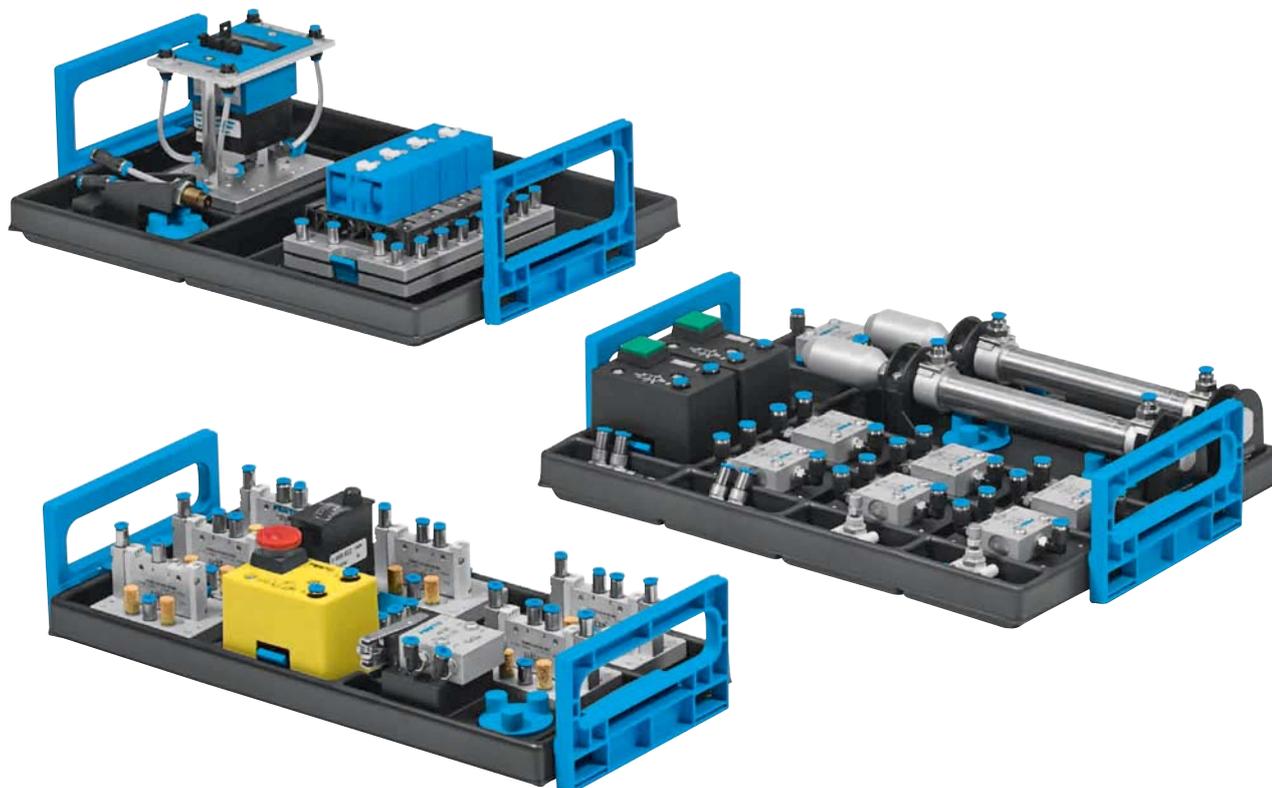
**Supplementary media**

- Design and simulation using FluidSIM®
- WBT Pneumatics
- Textbook Basic principles of pneumatics and electropneumatics
- Cutaway model case



# Equipment set TP 102 – Advanced level

## Advanced pneumatics training



### Develop the training aims from TP 101 and consolidate your knowledge.

Fully revised: The new workbook contains a series of graduated project exercises based on actual industrial applications and an enhanced section on fundamentals. It also includes a multimedia CD-ROM. The foundation for competent training. Place your order now!

The number of components and the design are specially tailored to the projects contained in the workbook so that the main training aims can be achieved with little outlay. Delivered in practical, Systainer-compatible equipment trays.

Components from the equipment set TP 101 are required to carry out the projects.

### Training aims

- Binary reducing stages
- End positions without limit switches
- Latching circuits
- Converting 5/2-way valves
- Function of a back pressure end stop
- Basic stepper control (continuous cycle)
- Stepper control with operating modes or idle step
- Setting and coordinating time delays
- Variable step repetition using a predetermining counter
- Input circuit with self-latching loop and auxiliary functions
- Evaluating and using sensors for material sensing
- Realising stepper control with protected pilot air and auxiliary functions
- Proximity sensors in the end positions and in the partial stroke range
- Combined use of quick exhaust valves and pressure regulators
- Inversion of a timer signal
- Varying end-position cushioning
- Using and adjusting different sensor types

### Performance through close proximity

Switches and valves should be mounted as close to the actuator as possible for optimum performance. You can now apply the same principle thanks to the new components that can be plugged in directly. Furthermore, this approach also provides you with an easy way of demonstrating the features of a one-way flow control valve. You can even record the measured values and analyse the results, for example using the new TP 210!

### Lever valves

All of the lever valves contained in the training packages 101 and 102 are equipped with a pilot control, which means they require a low actuating force and deliver high reliability.

**Complete equipment set TP 102 in equipment tray 540711**

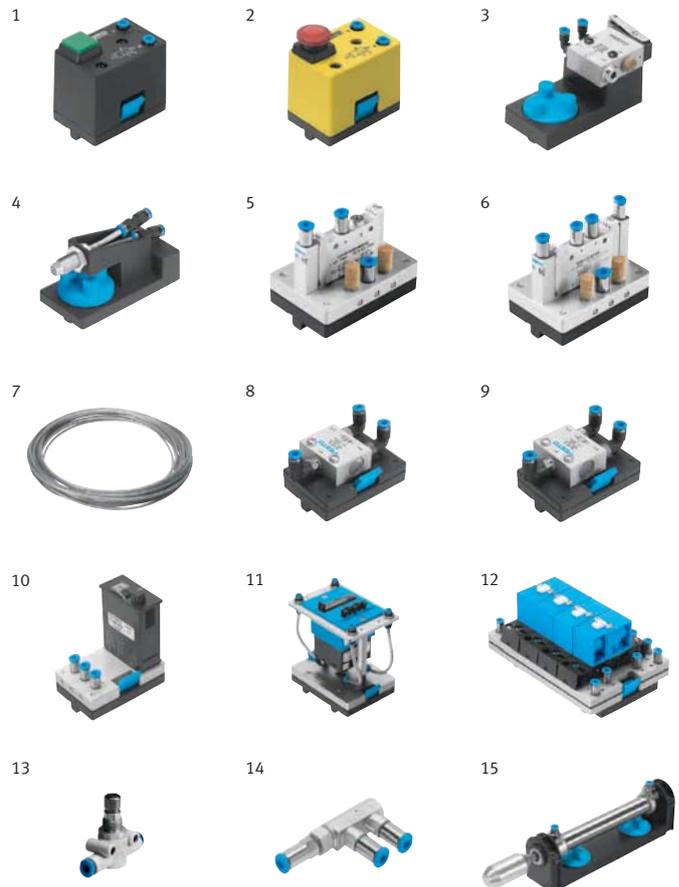
The most important components at a glance:

1	2x 3/2-way valve with pushbutton actuator, normally closed	152860
2	1x 3/2-way valve with mushroom-head emergency switch, normally open	152864
3	1x 3/2-way roller lever valve with idle return, normally closed	152867
4	1x Back pressure valve	152868
5	4x 3/2-way valve, pneumatically actuated at one end	576302
6	2x 5/2-way double pilot valve, pneumatically actuated at both ends	576303
7	2x Plastic tubing, 4 x 0.75 silver 10 m	151496
8	4x Shuttle valve (OR)	539771
9	3x Dual-pressure valve (AND)	539770
10	1x Pneumatic timer, normally open	539759
11	1x Pneumatic preset counter	152877
12	1x Stepper module	152886
13	2x One-way flow control valve	193967
14	2x Non-return valve, delockable	540715
15	2x Double-acting cylinder	152888

Accessories, also order:

Aluminium profile plate → Page 238

Compressor → Page 240



Also order:

**Workbook**



As a continuation of the basic level for pneumatics, the advanced level includes ten additional, challenging tasks which are suitable for the TP 102 equipment set. The documents are targeted at experienced pneumatics technicians. New features of this revised and updated edition include revised exercise sheets for practical use during instruction.

The workbook includes:

- Sample solutions
- Training notes
- Multimedia CD-ROM with graphics, photos of industrial applications, animations and FluidSIM® circuit diagrams
- Exercise sheets for trainees

Campus licence (→ Page 53):

de	540672
en	541089
es	542504
fr	542508

**Supplementary media**

- Design and simulation using FluidSIM®
- WBT Pneumatics
- Textbook Basic principles of pneumatics and electropneumatics
- Cutaway model case

# Equipment set TP 201 – Basic level

## Basic electropneumatics training



**Electropneumatics, Basic level.**  
The most important basic principles in one compact book.

### Top solenoid valves for training

Easy connection of the solenoid coils via 4 mm safety sockets with LED indicator for actuation. The manual override latches and allows very easy error simulation. The port pattern is as per the current symbols to DIN ISO 1219. The newest valve technology is compact, sturdy and inexpensive with the Didactic-Plus, and of course comes with the reliable Quick-Fix® mounting system.

### Electronic proximity sensors – compatible and reliable

These proximity sensors are based on the same slot mounting system as the pneumatic proximity sensors in TP 101. We opted for short circuit-proof, electronic proximity sensors due to their long service life in training applications.

### Logic programming? That's logical.

The basic principles are established with relay control systems and the new supplementary equipment sets "Controllers for fluid engineering" are used according to individual requirements.

### Training aims

- Structure, function and application of single-acting and double-acting cylinders
- Calculating basic parameters
- Direct and indirect actuation
- Application and function of 3/2 and 5/2-way solenoid valves
- Analysing circuits
- Options for pressure measurement systems
- Pressure-dependent control systems
- Latching circuits
- Logic operations: AND/OR/NOT
- Combining logic operations
- Function and application of limit switches
- Time delay valves
- End-position monitoring using electronic proximity sensors
- Realising oscillating movement

- Economic considerations of using pneumatic components
- Troubleshooting simple electro-pneumatic circuits

The **workbook** contains a series of graduated project exercises based on actual industrial applications, an enhanced section on fundamentals and a multimedia CD-ROM. The foundation for competent training. Place your order now!

The number and the design of components are specially tailored to the projects contained in the workbook so that the main training aims can be achieved with little outlay. Delivered in practical, Systainer-compatible equipment trays.

Also order:

### Workbook



Campus licence (→ Page 53):

de	540673
en	541090
es	542505
fr	542509

### Supplementary media

- FluidSIM® Pneumatics
- WBT Electropneumatics
- Textbook Basic principles of pneumatics and electropneumatics
- Transparency set, Electropneumatics

**Complete equipment set TP 201 in equipment tray 540712**

The most important components at a glance:

1	1x Signal input, electrical	162242
2	2x Relay, three-fold	162241
3	1x Limit switch, electrical, left-actuated	183322
4	1x Limit switch, electrical, right-actuated	183345
5	1x Proximity sensor, optical, M12	572744
6	2x Proximity sensor, electronic, with cylinder mounting	2344752
7	1x 2 x 3/2-way solenoid valve with LED, normally closed	567198
8	1x 5/2-way solenoid valve with LED	567199
9	2x 5/2-way double solenoid valve with LED	567200
10	1x Pressure sensor with display	572745
11	4x One-way flow control valve	193967
12	1x Single-acting cylinder	152887
13	2x Double-acting cylinder	152888
14	1x Start-up valve with filter control valve	540691
15	1x Manifold	152896
16	1x Plastic tubing, 4 x 0.75 silver 10 m	151496

Accessories, also order:

Aluminium profile plate → Page 238
Compressor → Page 240
Tabletop power supply unit → Page 239
Power supply unit for mounting frame → Page 239
4 mm Safety laboratory cables → Page 247

**Supplementary equipment set to upgrade from Pneumatics, Basic level TP 101 to Electropneumatics, Basic level TP 201**

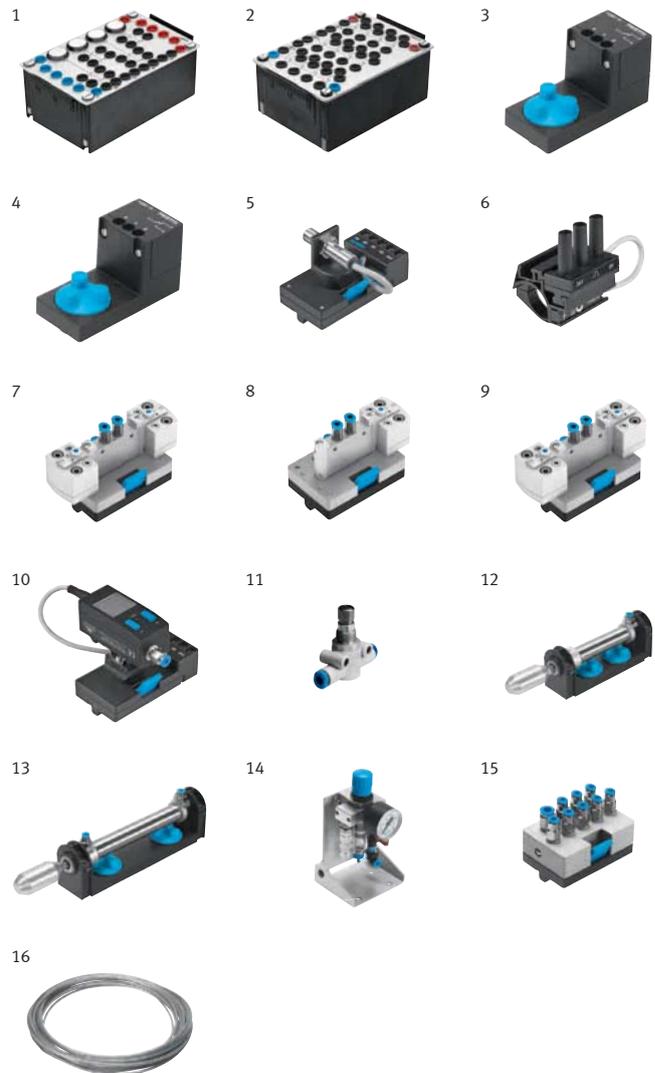
Supplements the Pneumatics, Basic level TP 101 equipment set to form a complete Electropneumatics, Basic level TP 201 equipment set.

Recommended training media and accessories: See TP 201

**Complete supplementary equipment set TP 101 – TP 201 in equipment tray 540717**

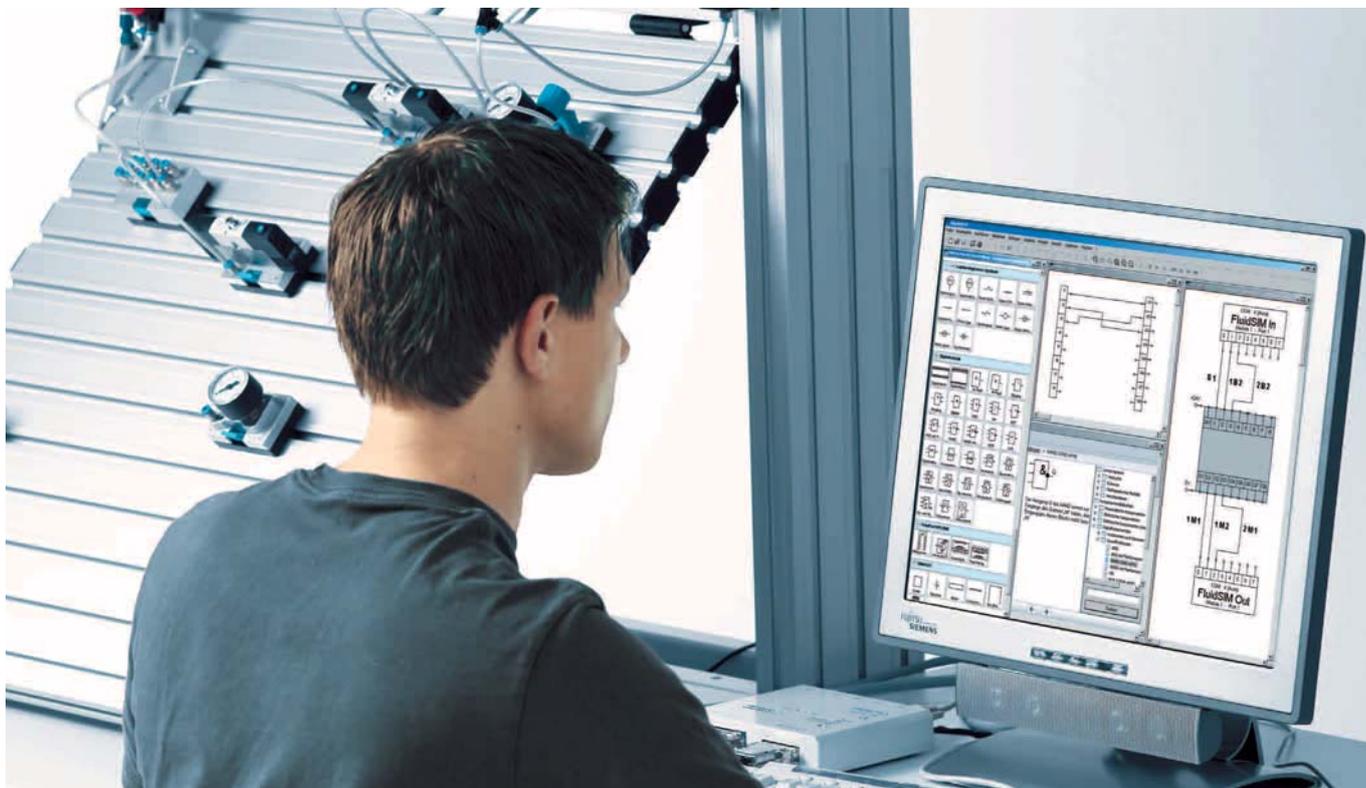
The most important components at a glance:

1	1x Signal input, electrical	162242
2	2x Relay, three-fold	162241
3	1x Limit switch, electrical, left-actuated	183322
4	1x Limit switch, electrical, right-actuated	183345
5	1x Proximity sensor, optical, M12	572744
6	2x Proximity sensor, electronic, with cylinder mounting	2344752
7	1x 2 x 3/2-way solenoid valve with LED, normally closed	567198
8	1x 5/2-way solenoid valve with LED	567199
9	2x 5/2-way double solenoid valve with LED	567200
10	1x Pressure sensor with display	572745
11	2x One-way flow control valve	193967
13	1x Double-acting cylinder	152888



# Supplementary equipment sets

## Controllers for electropneumatics



According to the basic principles of control technology with relay modules, further control systems are available as equipment extension kits for TP 201 and TP 601. The relay modules are replaced by the following equipment set:

**Controlling using FluidSIM®**  
Introduction to logic programming with a soft PLC

Additional controllers →  
Chapter Automation technology/PLC training packages

### **Supplementary equipment set Controlling using FluidSIM®/ EasyPort USB**

With this package, the FluidSIM® software can be used to control training packages. FluidSIM® controls via EasyPort USB and processes the inputs and outputs connected to the universal connection unit according to their programming, e.g. using the digital module contained in FluidSIM®.

The Controlling using FluidSIM® package contains everything you need to control training packages TP 201 and TP 601. FluidSIM® Pneumatics is required for TP 201 and FluidSIM® Hydraulics for TP 601. A set of brief instructions provides information on the individual steps.

The sample solutions are included on a data storage medium as FluidSIM® CT programs.

**Complete supplementary equipment set Controlling using FluidSIM/EasyPort USB in equipment tray** **556270**

The most important components at a glance:

1	1x Brief instructions FluidSIM, de/en/es/fr	556267
2	1x EasyPort USB	548687
3	1x Quick-Fix screw adapter	549806
4	1x Universal connection unit, digital (SysLink)	162231
5	1x I/O data cable with SysLink connectors (IEEE 488), 2.5 m	34031

Prerequisite:

Equipment set TP 201 – Basic level → Pages 108 – 109

FluidSIM Pneumatics → Pages 36 – 37

Necessary accessories, also order:

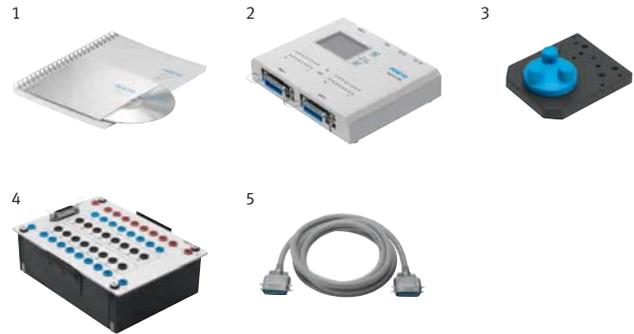
Aluminium profile plate → Page 238

Compressor → Page 240

Tabletop power supply unit → Page 239

Power supply unit for mounting frame → Page 239

4 mm Safety laboratory cables → Page 247



# Equipment set TP 202 – Advanced level

## Advanced electropneumatics training



### Electropneumatics, Advanced level. The next Step!

This training package supplements the training aims of TP 201.

The new workbook contains a series of graduated project exercises based on actual industrial applications, an enhanced section on fundamentals and a multimedia CD-ROM. The foundation for competent training. Place your order now!

The number and the design of components are specially tailored to the projects contained in the workbook so that the main training aims can be achieved with little outlay. Delivered in practical, Systainer-compatible equipment trays.

Components from the equipment set TP 201 are required to carry out the projects.

### Training aims

- Describing the structure and application of valve terminals
- Realising sequence controls with signal overlap – solution according to the group method, sequence chain with spring-return valves and sequence chain with bistable valves
- Describing and setting operating modes
- Describing the function and application of a predetermining counter
- Explaining and realising an emergency stop function using spring-return valves
- Emergency stop conditions
- Explaining the function and application of a 5/3-way solenoid valve
- Describing and setting the operating mode 'Set'
- Troubleshooting in complex electropneumatic circuits

### Fundamentals of modern pneumatics – valve terminals

This training course helps you to lay the foundation for using valve terminals. Designed for a wide range of industries, requirements and applications, valve terminals are sturdy and durable – an investment in the future. The MPA valve terminal used consists of 2 x 5/2-way solenoid valves and 2 x 5/2-way double solenoid valves.

### Electrical emergency stop pushbutton

Safety engineering is an important topic, but one that is often neglected in training. The new TP 202 takes an in-depth look at the emergency stop function and also describes the emergency stop function under special conditions. After all, you don't want to end up with a pressure-less and voltage-less system after pressing the emergency stop button!

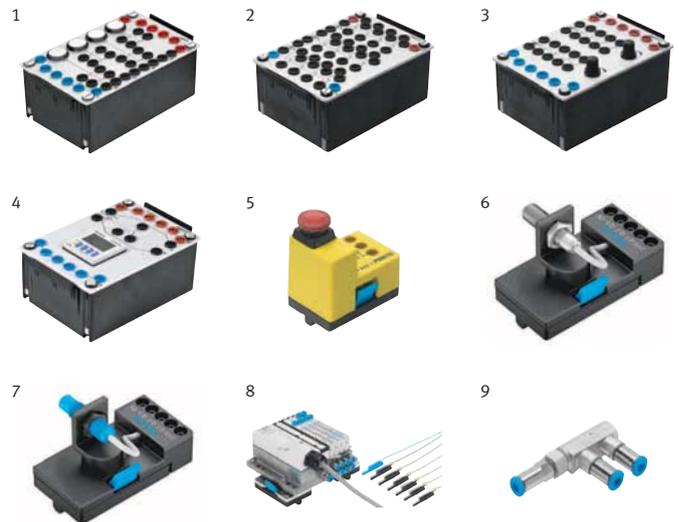
**Complete equipment set TP 202 in equipment tray 540713**

The most important components at a glance:

1	1x Signal input, electrical	162242
2	2x Relay, three-fold	162241
3	1x Time relay, two-fold	162243
4	1x Preset counter, electronic	1677856
5	1x Emergency stop pushbutton, electrical	183347
6	1x Proximity sensor, inductive, M12	548643
7	1x Proximity sensor, capacitive, M12	548651
8	1x Valve terminal with 4 valve slices (MMJ)	540696
9	2x Non-return valve, delockable	540715

Accessories, also order:

Aluminium profile plate → Page 238
Compressor → Page 240
Tabletop power supply unit → Page 239
Power supply unit for mounting frame → Page 239
4 mm Safety laboratory cables → Page 247



Also order:

**Workbook**



As a continuation of the basic level for electropneumatics, the advanced level includes twelve additional, challenging tasks which are suitable for the TP 202 equipment set. The documents are targeted at experienced pneumatics technicians. New features of this revised and updated edition include revised exercise sheets for practical use during instruction.

The workbook includes:

- Sample solutions
- Training notes
- Multimedia CD-ROM with graphics, photos of industrial applications, animations and FluidSIM® circuit diagrams
- Exercise sheets for trainees

Campus licence (→ Page 53):

de	540674
en	541091
es	542506
fr	542510

**Supplementary media**

- Design and simulation using FluidSIM®
- WBT Electropneumatics
- DVD Electropneumatics/ Electrohydraulics

## Equipment set TP 210 – Advanced level

### Measurement and control in pneumatics with FluidLab®-P



#### Fit for tomorrow?

The TP 210 equipment builds on the training content of the TP 101 and TP 201 equipment sets on the topic of pneumatic measurement and control. The training content ranges from the simple measurement of individual, pneumatic components, basic principles of status monitoring (condition monitoring) to (closed-loop) control technology with discontinuous (two-step action controller) and continuous controllers (PID controller).

In addition, great emphasis is placed on raising awareness of how to handle compressed air responsibly as a form of energy.

Exercises for measuring and analysing system and control behaviour help you to get prepared for a future in which diagnostics, preventative maintenance and saving energy are becoming increasingly important.

#### Something extra special

In order to complete the exercises, sensors (e.g. pressure, flow and proximity sensors) are connected to the inputs and control signals are guided to the EasyPort USB outputs. The signals are interpreted and visualised on computer by the FluidLab®-P software included in the scope of delivery. Analogue values are displayed as measurement curves.

Instructions on how to complete the exercises, positional sketches and block circuit diagrams are included with each exercise, so that you are guided step by step through each of the tests. Measured results are then interpreted, compared with sample solutions and you will be asked to answer questions about comprehension.

#### Course topics

- Basic principles of analogue data processing
- Application and adaptation of sensors
- Interpretation of measurement results
- Reading and understanding of technical data and measurement curves
- Fluid engineering components, their influence and function
- Demonstrating fluid engineering effects and special features
- Analytical fault finding
- Saving energy
- Evaluation of changes in status
- Proportional technology
- Control technology with continuous and discontinuous controllers

#### The benefits to you

- Fast, PC-supported recording of measured values
- Greater training success through measurement of components and interpretation of results
- Sensors that enable students “to look into” the circuit and components
- Suppositions regarding system behaviour can be easily proven
- Learning the principles of measurement and analysis and applying them directly in other circuits
- Demonstrating and understanding the principles of fluid engineering faster
- System analysis via PC: state-of-the-art diagnostic method
- Better understanding of fluid engineering components and processes and thus higher quality of training

**Complete equipment set TP 210 in equipment tray 556228**

The most important components at a glance:

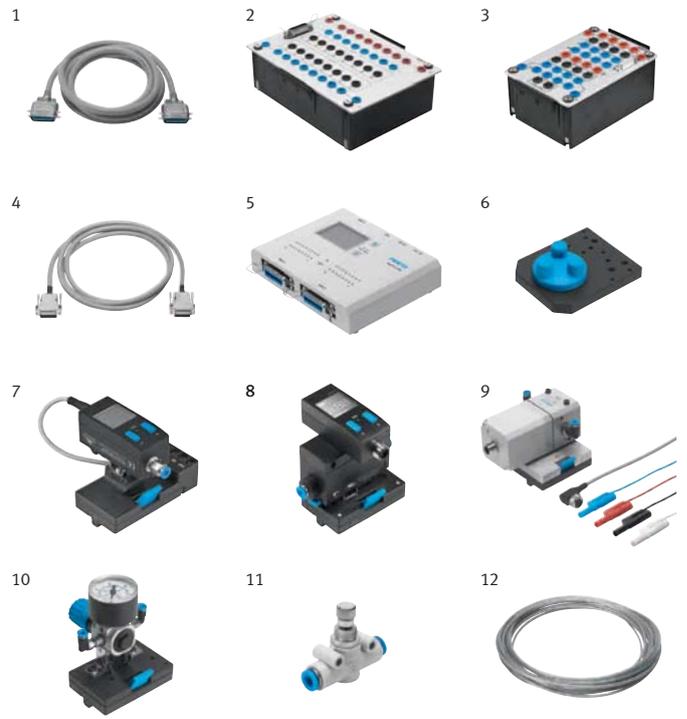
1	1x I/O data cable with SysLink connectors (IEEE 488) at both ends, 2.5 m	34031
2	1x Universal connection unit, digital (SysLink)	162231
3	1x Connection unit, analogue	567232
4	1x Analogue cable, parallel, 2 m	529141
5	1x EasyPort USB	548687
6	1x Quick-Fix screw adapter	549806
7	2x Pressure sensor with display	572745
8	1x Flow sensor, 0.5 – 50 l/min, analogue	8036235
9	1x Proportional-pressure regulator	539779
10	1x Pressure regulator valve with gauge	539756
11	3x Flow control valve	193972
12	1x Plastic tubing, 4 x 0.75 silver 10 m	151496
	1x FluidLab-P Single license, de/en	556241
	2x Non-return valve, delockable	540715

Option force measurement:

For piston force measurement exercises the force sensor (Order no. 539780) not included in scope of delivery is required.

Accessories, also order:

Aluminium profile plate → Page 238	
Compressor → Page 240	
Tabletop power supply unit → Page 239	
Power supply unit for mounting frame → Page 239	
4 mm Safety laboratory cables → Page 247	
Force sensor	539780



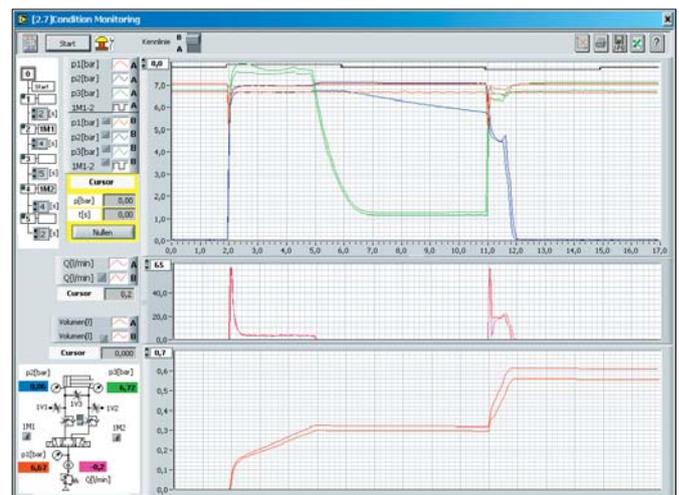
**FluidLab®-P inclusive**

The FluidLab®-P software for recording measured values is an important component of the training package TP 210. Just a few simple steps are needed to configure the interface, adapt the sensors and select the language. Exercises can then be started. These are divided into the areas basic tests, cylinder controls, proportional technology and control technology. Exercises are supported by connection diagrams, descriptions and sample solutions. The measurement process is also software-controlled. Results can be measured with measuring points, printed out or exported to a spreadsheet program. The software also includes the complete book of exercises in PDF format.

**System requirements**

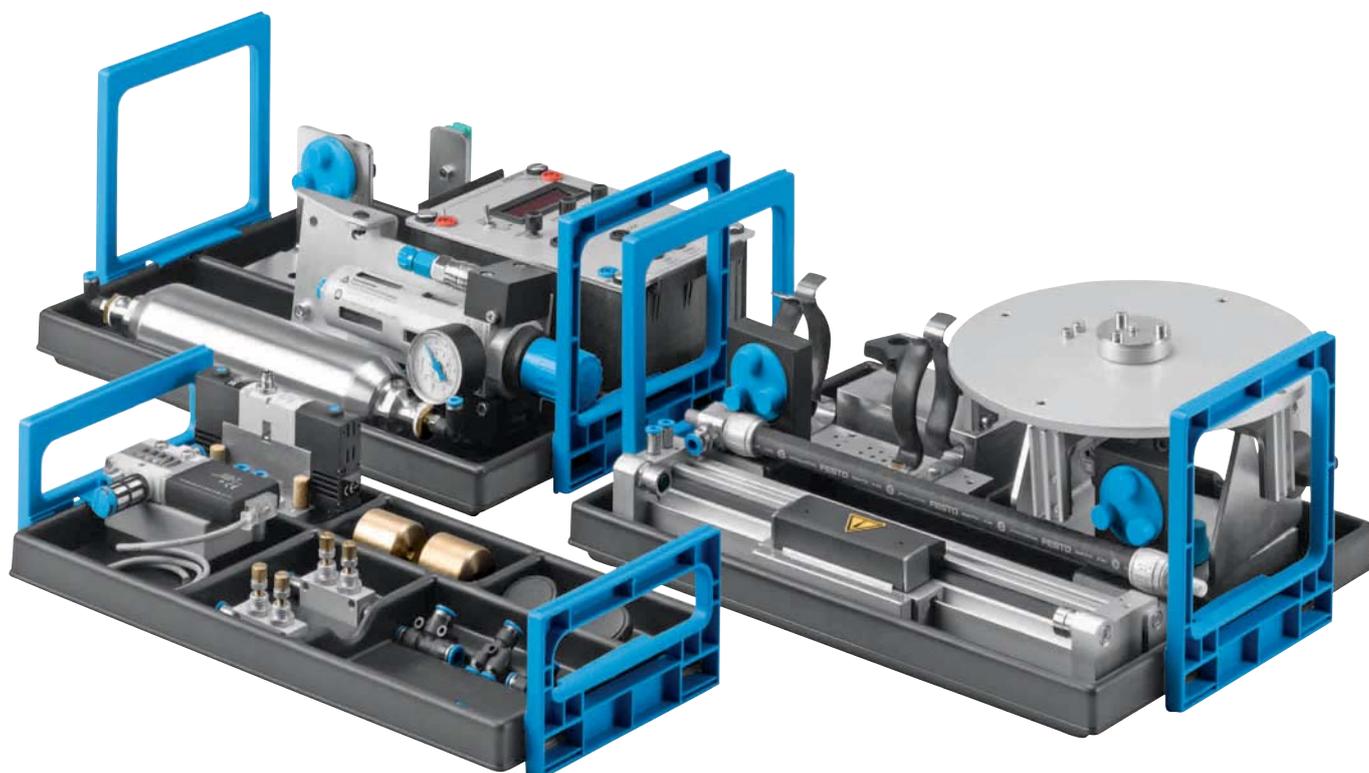
- PC with Windows XP/7/8
- Pentium® III or equivalently
- 2 GB RAM
- CD-ROM disk drive
- USB 2.0 or serial interface
- 1280 x 1024 pixels
- NI LabView 2012 Runtime (included in scope of delivery)

Components from the TP 101 and TP 201 equipment sets are required in order to complete the exercises.



# Equipment set TP 220 – Advanced level

## Drives in pneumatics



### Optimum drive

The TP 220 supplements the TP 201 training package by teaching the basics of pneumatic drives. The training content features the selection and sizing of various state-of-the-art drive types, taking into account their individual properties as well as commercial and safety considerations. Each drive unit remains clearly defined as an individual design, and so meets the needs of the various entry levels. Use of industrial components throughout emphasises the essential practicality and ensures rapid transfer of knowledge from training into practice.

We recommend connection to a compressed air system delivering approx. 100 l/min.

### Training aims

- Designing a compressed air network
- Sizing the pneumatic power section
- Influence of tubes and fittings on speed
- Reducing cost by using different pressures for advance and return strokes
- Reducing cost by avoiding leakage
- Operating behaviour of linear drives
- Calculation of mass moment of inertia
- Operating characteristics of rotary drives
- Function, control and selection of the fluidic muscle
- Comparison between standard cylinders and the fluidic muscle
- Response of pneumatic controls to power failure

Also order:

### Workbook

Describes in detail the issues and projects in 16 exercises closely linked to industrial practice, each comprising a problem description and work assignment. Worksheets support the students through the required stages of planning, execution and monitoring.

The workbook includes:

- Sample solutions
- Training notes
- Multimedia CD-ROM with graphics, photos of industrial applications
- Exercise sheets for trainees

Campus licence (→ Page 53):

de	549982
en	559880
es	559881
fr	559882



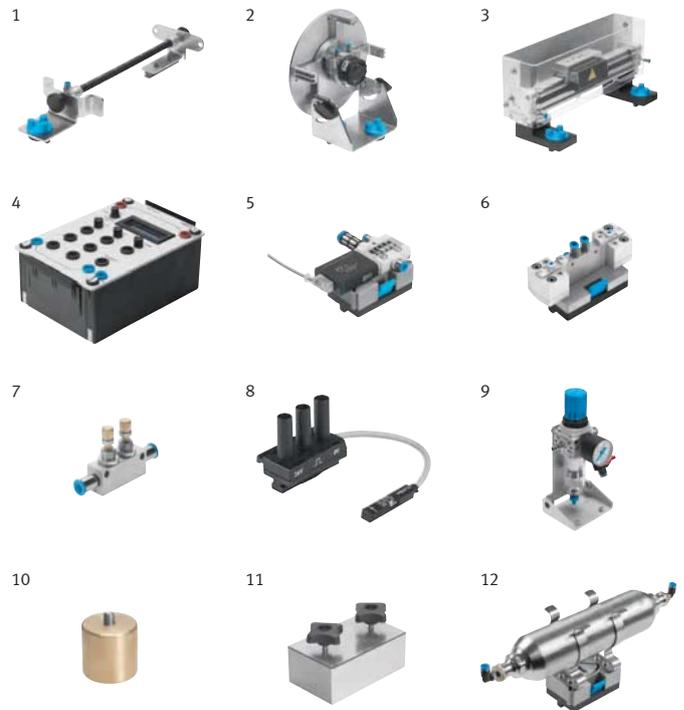
**Complete equipment set TP 220 in equipment tray** **541184**

The most important components at a glance:

1	1x Fluidic muscle, size 10	544311
2	1x Semi-rotary drive, size 16, 184°	544313
3	1x Linear drive, size 18, 170 mm stroke	548641
4	1x Function generator/counter/stopwatch	544315
5	1x 3/2-way fast-switching solenoid valve, normally closed	544312
6	1x 5/3-way solenoid valve, mid position closed	567201
7	2x One-way flow control valve	548634
8	1x Proximity sensor, electronic	2342009
9	1x On-off valve with filter regulating valve	152894
10	2x Weight, 175 g	548581
11	1x Weight, 2 kg	548582
12	1x Air pressure reservoir, 0.4 l	152912

Accessories, also order:

Aluminium profile plate	→ Page 238
Tabletop power supply unit	→ Page 239
Power supply unit for mounting frame	→ Page 239
4 mm Safety laboratory cables	→ Page 247



**Fluidic muscle**

The fluidic muscle is a pull actuator which imitates the action of a biological muscle. Judder free, it offers up to 10 times the initial force of normal cylinders of the same diameter. You will learn how the muscle can be deployed as a single-acting actuator.



**Semi-rotary drive**

In a semi-rotary drive the force is transmitted directly to the drive shaft via a rotary vane. The swivel angle is freely adjustable from 0 to 184°. You will learn the significance of the mass moment of inertia to a semi-rotary drive, and how its operating behaviour under load can be influenced in various mounting positions.



**Linear drive**

The rodless cylinder is mechanically coupled to the slide unit, which directly supports loads. You will learn the steps needed to attain optimum operating behaviour, and which applications are most suited to the various options.

# Equipment set TP 230 – Advanced level

## Vacuum technology



### Vacuums in handling technology

Training package TP 230 follows on from the training content in TP 201 focusing on the topic of handling technology using a vacuum.

The use of suction grippers to handle workpieces has become an integral part of handling technology as they offer advantages such as the ease of construction and the gentleness of the grippers. Suction grippers also enable rapid cycle times, and the investment required is comparatively low.

### Training content

Low pressure generation and system design:

- Function and use of ejectors according the Venturi principle
- Effects of system pressure on the attainable low pressure and the evacuation time
- Sizing and setting up a vacuum system

Selecting suction grippers:

- Shape and materials
- The relevance of gripper types and workpiece shape
- How the holding force is affected by the workpiece surface and the diameter of the suction cup

Typical switching for a vacuum system:

- Using a vacuum security valve when some of the suction cups are not gripping
- Using a pressure switch to monitor the low pressure level
- Reducing the compressed air consumption in a vacuum system
- Controlled release and ejection of workpieces from the suction gripper

Components from the equipment set TP 201 are required to carry out the projects.

All the workpieces required to complete the tasks are included in the scope of delivery.

Complete equipment set TP 230 in equipment tray **573041**

The most important components at a glance:

1	1x Air pressure reservoir, 0.4 l	152912
2	1x Pressure switch, 0 – -1 bar	548624
3	1x Vacuum gauge	573042
4	1x Flow control valve	193972
5	1x Vacuum generator, type H	573258
6	1x Vacuum generator, type L	573259
7	1x Non-return valve	153462
8	1x Non-return valve, delockable	540715
9	1x Suction gripper 20 SN	573043
10	1x Suction gripper 30 SN	573044
11	1x Suction gripper 20 SS	573045
12	1x Suction gripper 30 SS	573046
13	2x Suction gripper 20 CS with vacuum security valve	573047
14	1x Suction gripper 4x20 ON	573257

Different materials and workpieces

Necessary accessories, also order:

Aluminium profile plate → Page 238
Compressor → Page 240
Tabletop power supply unit → Page 239
Power supply unit for mounting frame → Page 239
4 mm Safety laboratory cables → Page 247

Also order:

**Workbook**



In addition to six comprehensive project tasks for step-by-step construction and testing of the vacuum system, the package also includes basic information on the following topics: **Introduction to vacuum technology** – basic concepts of vacuum technology, vacuum ranges, vacuum generation in handling technology, vacuum pumps, functional principle of displacement pumps, instructions on selecting pumps, ejectors, ejector

units. **Vacuum elements in handling technology** – valves for vacuums, measuring and storing a vacuum, suction grippers, vacuum generation.

The workbook contains:

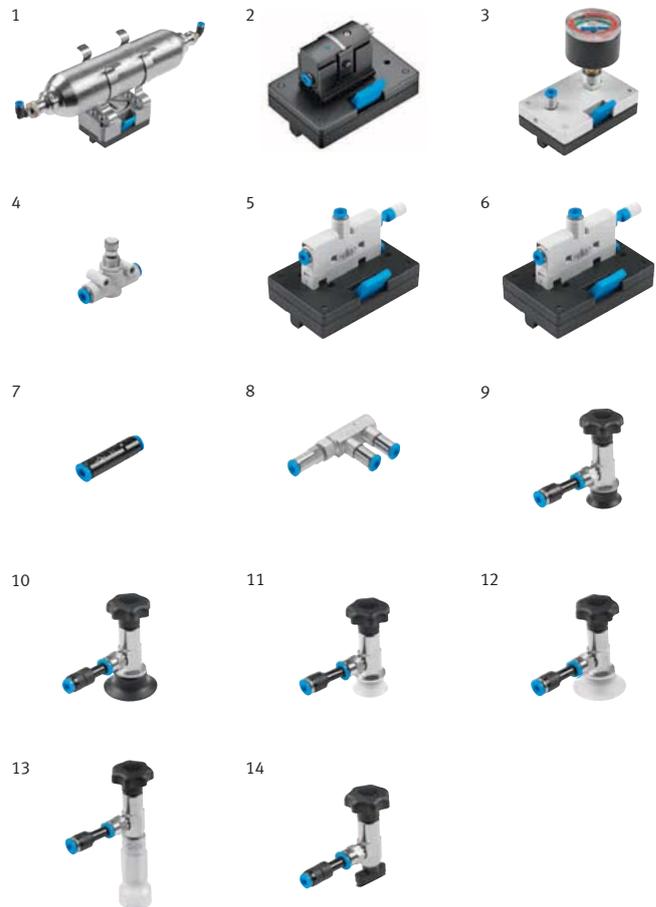
- Sample solutions
- Training notes
- Multimedia CD ROM with graphics and photos of industrial applications
- Worksheets for students

Campus licence (→ Page 53):

de	<b>567257</b>
en	<b>567258</b>
es	<b>567260</b>
fr	<b>567259</b>

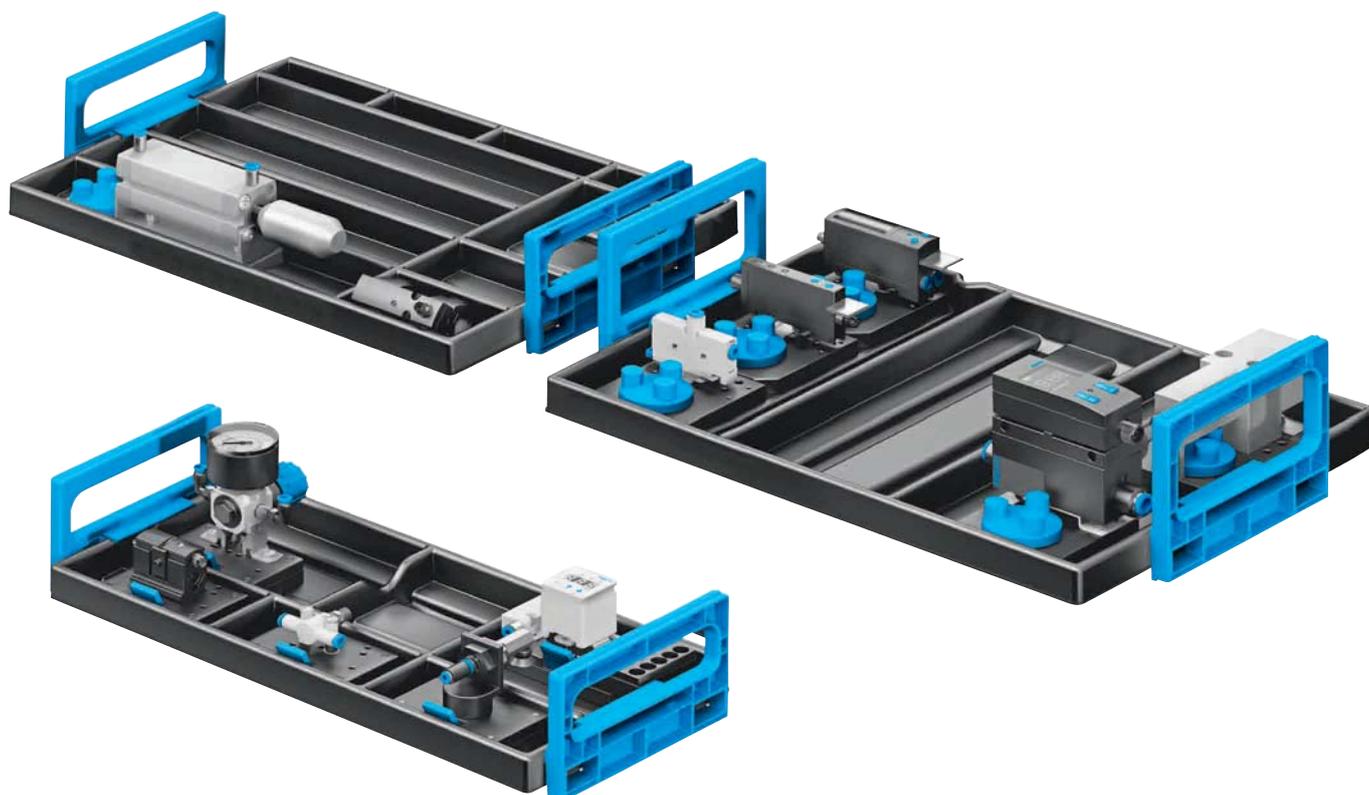
**Supplementary media**

- Designing and simulating with FluidSIM®
- Measuring and controlling with FluidLab®
- WBT Pneumatics
- WBT Electropneumatics
- Textbook Pneumatics/ electropneumatics
- Set of posters on pneumatics



# Equipment set TP 240 – Advanced level

## Sensors in pneumatics



### The purpose of a pneumatic control system

By using the TP 240 equipment set, you can expand the course topics of the TP 201 training package to include the topic of sensors in pneumatics.

With topics such as the application of pressure and flow rate sensors, the use of analogue position transmitters including the integration of signal converters and sensors for vacuum technology – the special requirements of sensors in pneumatic control-system environments are covered extensively.

Components from the TP 201 are required to carry out the projects.

### The special feature

The new advanced level is all about the subject of sensors in pneumatic control systems.

Hands-on experience plays a decisive role in teaching the contents. 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 240 a basic knowledge of sensors in pneumatics can be conveyed thoroughly.

### Course topics

- Basic principles of connection and circuit technology
- Basic principles of measured data acquisition and processing
- Configuration, function and application options of the sensors used
- Selecting appropriate sensors by taking into account certain parameters
- Various methods of pressure and flow measurement
- Differences between absolute, relative and differential pressure measurement
- Setting and checking sensors
- Using signal converters

Complete equipment set TP 240 in equipment tray **566908**

The most important components at a glance:

1	1x Position transmitter, 0 – 50 mm, analogue	560124
2	1x Signal converter for position transmitter	548621
3	1x Electronic pressure sensor, 0 – 10 bar	548622
4	1x Flow sensor, 0.5 – 50 l/min, analogue	8036235
5	1x Flow sensor, -1 – 1 l/min, analogue	548625
6	1x Pressure switch, 0 – -1 bar	548624
7	1x Vacuum generator	548628
8	1x Suction gripper, 10 mm diameter	560158
9	1x One-way flow control valve	560159
10	1x Pressure regulator valve with gauge	539756
11	1x Stop, 35 mm adjustment path	548630
12	1x Double-acting profile cylinder	549832

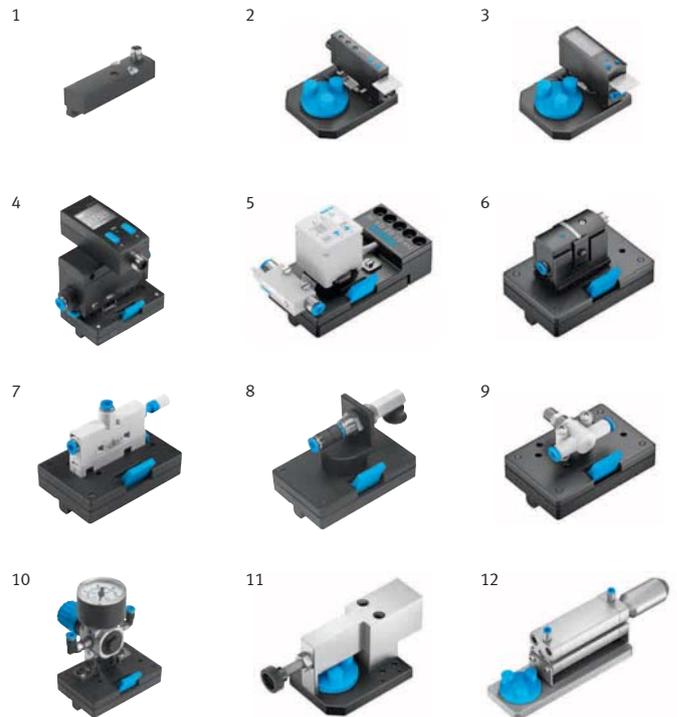
Accessories, also order:

Aluminium profile plate → Page 238

Tabletop power supply unit → Page 239

Power supply unit for mounting frame → Page 239

4 mm Safety laboratory cables → Page 247



Also order:

### Workbook



Ten projects based on industrial examples, suitable for equipment set TP 240, each including problem descriptions, parameters and project tasks, deal in detail with the specific subject of sensors in pneumatic control-system environments. The topics of pressure sensors, flow sensors, analogue position transmitters for pneumatic cylinders, signal converters and sensors for vacuum technology are covered comprehensively.

The workbook includes:

- Sample solutions
- Training notes
- Multimedia CD-ROM with graphics, photos of industrial applications, animations
- Exercise sheets for trainees

Campus licence (→ Page 53):

de	<b>566909</b>
en	<b>566910</b>
es	<b>566912</b>
fr	<b>566913</b>

### Supplementary media

- WBT sensor technology 1
- Textbook: Proximity switches
- Design and simulation using FluidSIM®
- Measurement and control using FluidLab®
- Set of posters on pneumatics

# Equipment set TP 250 – Advanced level

## Safety in pneumatic systems



### Risk reduction!

Just like good functionality and economic efficiency, safety is essential to the success of any product. What is more, new directives and laws require intelligent solutions and raise the level of professional skills required. As a result, there is a wide range of different products, information and qualifications for safety engineering. However, most of these focus on the control level, meaning that safety usually only goes as far as the output of a fail-safe PLC, for example. Risks can also arise outside of the power section, however, so it is important that systems include risk reduction measures to cope with such problems.

But what does the “pneumatics specialist” entrusted with the commissioning, troubleshooting, set-up, maintenance and simple optimisation of a system need to know? And how can this knowledge be conveyed in a clear manner, with easy-to-follow steps?

### TP 250!

TP 250 builds on the training content of TP 101 and TP 201, focusing on the systematic optimisation of safety in pneumatic systems. The aim of the training package is to detect risks in pneumatic processes, to assess the risks for a simple “machine” and to learn what measures can be used to reduce risks and how to implement them properly.

### Training content

- Reducing pressure and force according to the work to be performed
- Reducing the speed and acceleration while observing the cycle time and the flow control for the specific loading conditions
- Emergency stop and release: suitable measures for stopping and properly recommissioning a pneumatic drive
- Suitable measures in case of compressed air failure and return, as well as instructions on how to store and use auxiliary energy
- Suitable measures in case of power failure and return
- Getting to know the operating modes and signals for operating statuses
- Using sensors to detect malfunctions
- Increasing the performance level using a dual-channel emergency stop system
- Selecting and using suitable protective measures

Components from equipment sets TP 101 and TP 201 are required to carry out the projects.

Mounting the pneumatic system, consisting of cylinders, weight and cover, is done on the profile column of a Learnline workstation. If there is no profile column available, the mounting kit for Learntop S (order no. 526847) or the mounting kit for vertical slotted profile plates (order no. 533528) can be used. Two of each of these are needed.

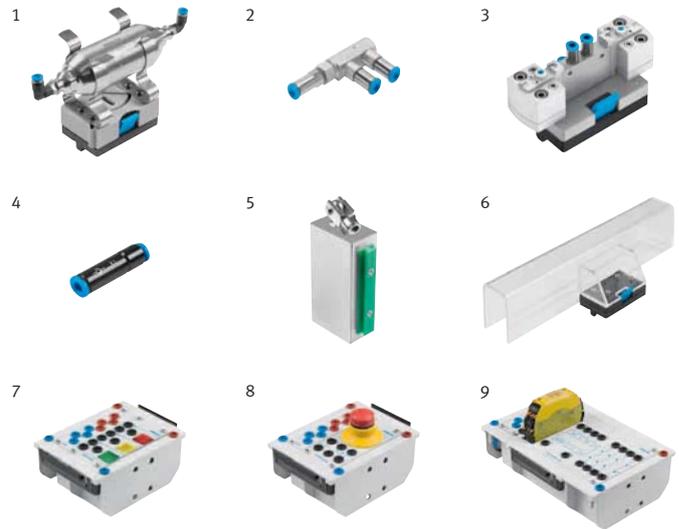
Complete equipment set TP 250 in equipment tray **567264**

The most important components at a glance:

1	1x Air pressure reservoir, 0.1 l	573281
2	2x Non-return valve, delockable	540715
3	1x 5/3-way double solenoid valve, mid position closed	567201
4	1x Non-return valve	153462
5	1x Weight, 2 kg for cylinder	572778
6	1x Cover for cylinder	572777
7	1x Operational status display	567263
8	1x Mushroom-head safety switch	567261
9	1x Safety relay for emergency stop and safety door	567262

Necessary accessories, also order:

Aluminium profile plate → Page 238
Compressor → Page 240
Tabletop power supply unit → Page 239
Power supply unit for mounting frame → Page 239
4 mm Safety laboratory cables → Page 247



Also order:

**Workbook**



The workbook contains project tasks of progressive difficulty level, together with the solutions for each exercise sheet. In these exercises, students reduce the potential risk level of a pneumatic system step by step. The basic level contains the following topics: overview of relevant standards, laws and regulations; overview and detailed description of operating modes; overview and detailed description of ten relevant safety functions; possible technical solutions for each safety function;

extensive illustrations and cross-sections to explain the design principles.

The workbook contains:

- Sample solutions
- Training notes
- Multimedia CD ROM with graphics and photos of industrial applications, safety guidelines, safety poster
- Worksheets for students

Campus licence (→ Page 53):

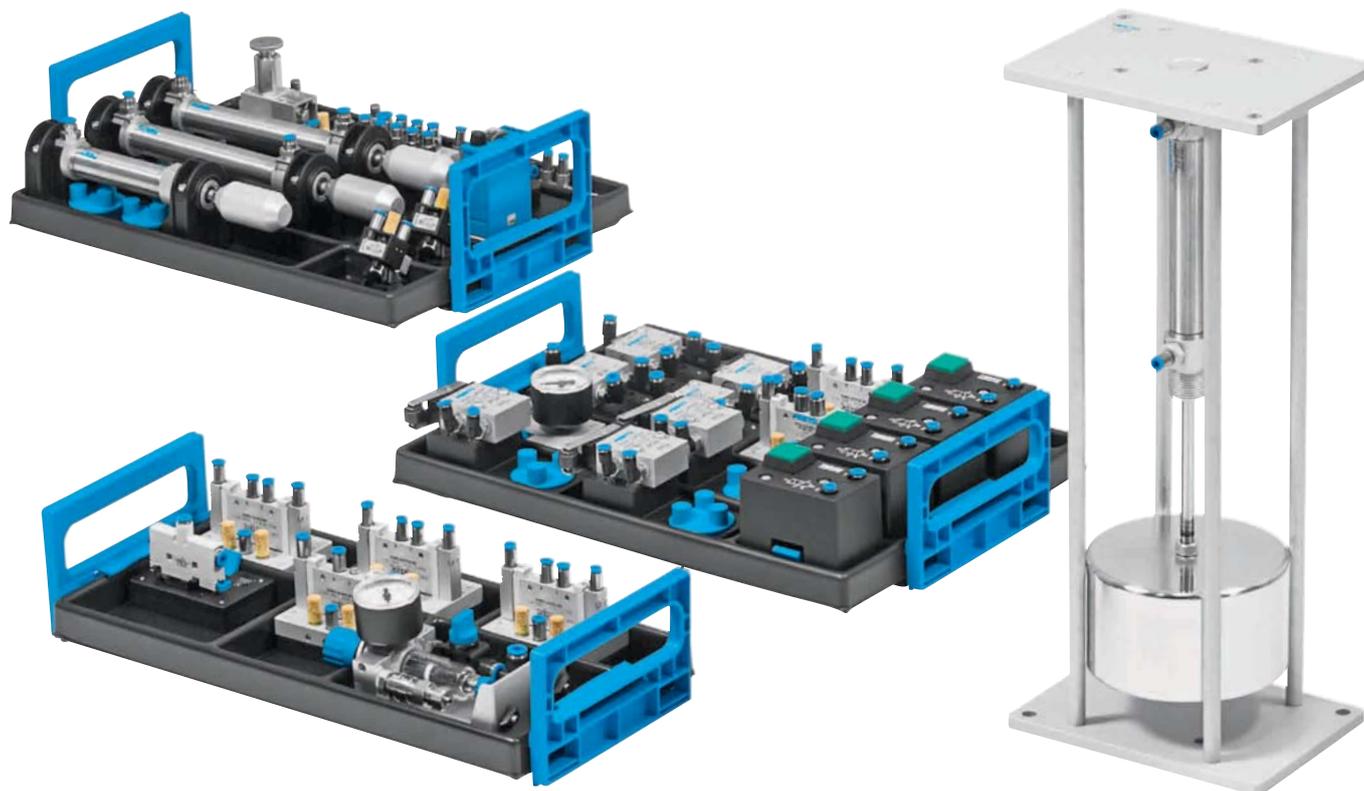
de	<b>567265</b>
en	<b>567266</b>
es	<b>567267</b>
fr	<b>567268</b>

**Supplementary media**

- WBT Safety engineering
- WBT Pneumatics
- WBT Electropneumatics
- Designing and simulating with FluidSIM®
- Measuring and controlling with FluidLab®
- Textbook Pneumatics/ electropneumatics
- Set of posters on pneumatics

# BIBB pneumatics equipment set

## Suitable for BIBB pneumatics course



### BIBB Pneumatics 2007/2008

The new edition of the “Pneumatic control technology” training course is recommended and published by the Bundesinstitut für Berufsbildung (BIBB, German Federal Institute for Vocational Education and Training).

Festo Didactic offers the suitable equipment set for this course.

The 2007/2008 edition contains a few new additions compared with the 1999 edition:

- Piloted non-return valves to stop pneumatic drives in any position in case of a drop in pressure.
- Pneumatic proximity sensors as a modern alternative to roller lever valves for cylinder sensing.
- Getting started in vacuum technology: vacuum generation with a venturi nozzle/laval nozzle and simple handling with suction grippers.

### The Festo Didactic Plus

A CD-ROM complete with all circuit diagrams for all the exercises and activities is an integral part of the scope of delivery. These are in CT file format for FluidSIM® Pneumatics and in PDF file format.

It goes without saying that all equipment set components are compatible with the Festo Didactic training package components.

This means you can either supplement your TP 101 with the BIBB pneumatics equipment set or your BIBB pneumatics equipment set with the TP 101.

A wealth of information on the basic principles of pneumatics!

Also order:

### Pneumatic control technology – exercises for trainees

Recommended and published by the Bundesinstitut für Berufsbildung (BIBB, German Federal Institute for Vocational Education and Training).

In addition to 11 exercises, which require the BIBB pneumatics equipment set, the following topics are also included:

- Compressed air generation
- Basic terms in control technology
- Servicing
- Maintenance
- Inspection
- Repair procedure
- Fault finding/analysis/documentation

### Pneumatic control technology – exercises and solutions

Recommended and published by the Bundesinstitut für Berufsbildung (BIBB) (German Federal Institute for Vocational Education and Training).

The “Pneumatic control technology, exercises for trainees” book contains questions for trainees about the 11 exercises, as well as the solutions and circuit diagrams.

de 90090

de 90070

**Complete equipment set BIBB Pneumatics in equipment tray 549840**

The most important components at a glance:

1	3x 3/2-way valve with pushbutton actuator, normally closed	152860
2	1x 3/2-way valve with pushbutton actuator, normally open	152861
3	3x 3/2-way roller lever valve, normally closed	152866
4	1x 3/2-way valve, pneumatically actuated at one end	576302
5	1x 5/2-way valve, pneumatically actuated at one end	576307
6	3x 5/2-way double pilot valve, pneumatically actuated at both ends	576303
7	1x 5/3-way valve, mid-position closed	576304
8	1x Pneumatic timer, normally closed	540694
9	1x Pressure sequence valve	152884
10	1x Shuttle valve (OR)	539771
11	3x Dual-pressure valve (AND)	539770
12	1x Quick-exhaust valve	539772
13	2x One-way flow control valve	193967
14	2x Non-return valve, delockable	540715
15	2x Proximity sensor, pneumatic, with cylinder attachment	2764815
16	1x Suction gripper, 10 mm diameter	560158
17	1x Vacuum generator	548628
18	1x Single-acting cylinder	152887
19	2x Double-acting cylinder	152888
20	1x Driving/tractive load	152889
21	1x Pressure gauge	152865
22	1x Start-up valve with filter control valve	540691
23	1x Manifold	152896
24	2x Plastic tubing, 4 x 0.75 silver 10 m	151496

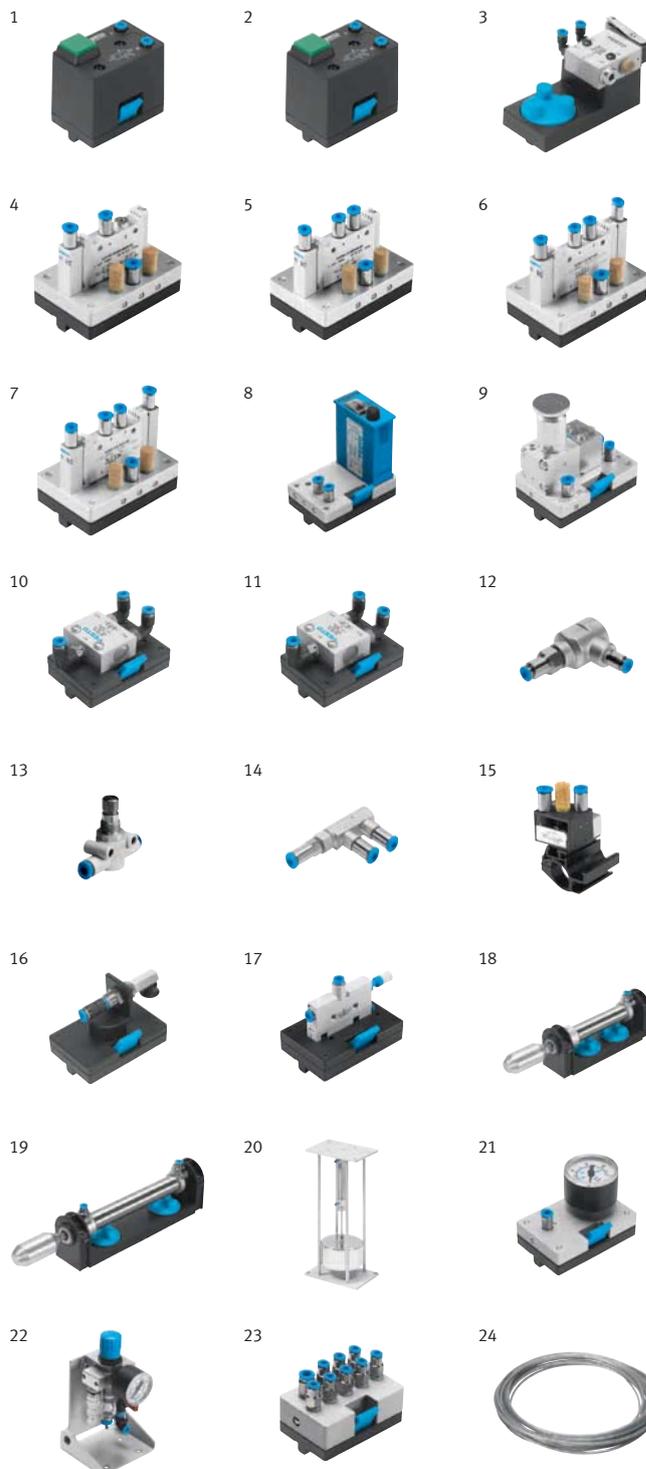
Accessories, also order:

Aluminium profile plate → Page 238

Compressor → Page 240

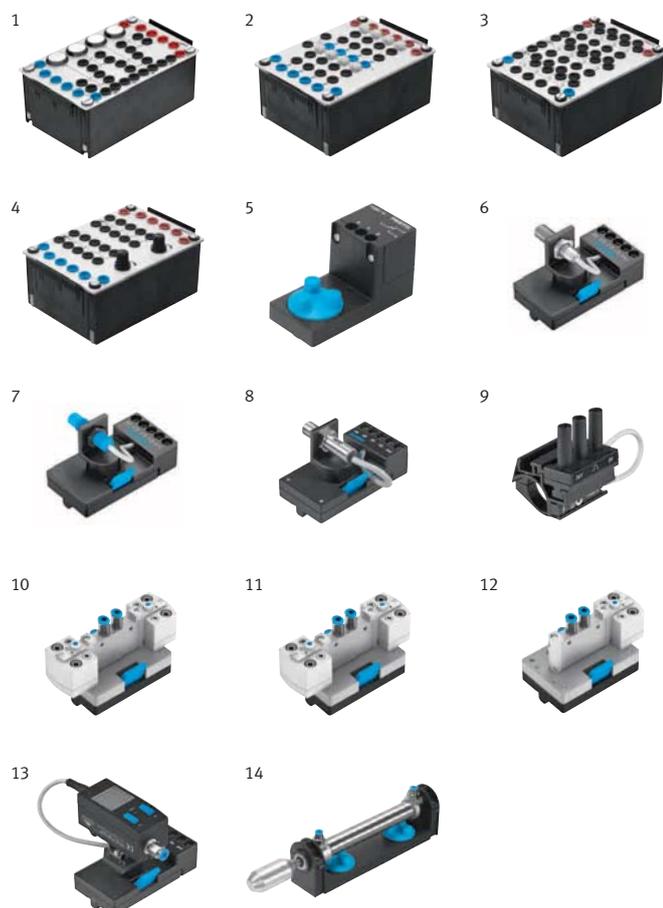
**Supplementary media**

- WBT Pneumatics
- FluidSIM® Pneumatics design and simulation program
- Cutaway model case
- Set of posters on pneumatics
- Textbook: Pneumatics, Basic level
- Workbook: Pneumatics, Basic level TP 101
- Workbook: Pneumatics, Advanced level TP 102
- GRAFCET drawing template



# BIBB electropneumatics equipment set

## Suitable for BIBB electropneumatics course



Complete equipment set BIBB Electropneumatics in equipment tray **184462**

The most important components at a glance:

1	2x Signal input, electrical	162242
2	1x Indicator unit and distributor, electrical	162244
3	2x Relay, three-fold	162241
4	1x Time relay, two-fold	162243
5	1x Limit switch, electrical, left-actuated	183322
6	1x Proximity sensor, inductive, M12	548643
7	1x Proximity sensor, capacitive, M12	548651
8	1x Proximity sensor, optical, M12	572744
9	2x Proximity sensor, electronic, with cylinder mounting	2344752
10	3x 5/2-way double solenoid valve with LED	567200
11	1x 2 x 3/2-way solenoid valve with LED, normally closed	567198
12	3x 5/2-way solenoid valve with LED	567199
13	1x Pressure sensor with display	572745
14	1x Double-acting cylinder	152888

Recommended accessories:

Aluminium profile plate → Page 238

Compressor → Page 240

Tabletop power supply unit → Page 239

Power supply unit for mounting frame → Page 239

4 mm Safety laboratory cables → Page 247

### Training aims

- Physical fundamentals of electrics and pneumatics
- Function and application of electropneumatic devices
- Representing motion sequences and switching states
- Constructing control systems using relays
- Electrical latching circuits
- Using magnetic proximity sensors
- Using pressure switches
- Directionally dependent control systems using sensors
- Directionally dependent control systems using predetermining counters
- Controllers with parameters (e.g. single/continuous cycle, EMERGENCY-OFF)
- Step diagram controls/process-controlled sequence controls
- Timing controls/time-controlled sequence controls
- Program controls with non-deleting and deleting sequencer
- Troubleshooting large electropneumatic control systems

The selection of components complies with the German Federal Institute for Vocational Training (Bundesinstitute für Berufsbildung (BIBB)) course.

### Recommended training media



- WBT Electropneumatics
- Design and simulation program, FluidSIM® Pneumatics

Also order:

### BIBB Electropneumatics course

de **93070**

and:

### Accompanying exercises, log sheets and exercise circuits

de **93080**

# Equipment set TP 111

## Basic closed-loop pneumatics training

Complete equipment set TP 111 in equipment tray **184467**

The most important components at a glance:

1	1x Signal input, electrical	162242
2	2x 3/2-way valve with pushbutton actuator, normally closed	152860
3	1x 2 x 3/2-way solenoid valve with LED, normally closed	567198
4	1x Pressure gauge	152865
5	2x One-way flow control valve	193967
6	1x On-off valve with filter/regulator, 5 µm	526337
7	1x Manifold	152896
8	1x Plastic tubing, 4 x 0.75 silver 10 m	151496
9	1x PID controller	162254
10	1x Comparator	162257
11	1x Pressure sensor, analog	167094
12	1x 5/3-way solenoid valve, mid position closed	567201
13	1x 5/3-way proportional valve	167078
14	2x Air pressure reservoir, 0.4 l	152912
15	1x Status controller	162253
16	1x Linear drive, pneumatic, with guide and accessories	192501
17	1x Position encoder	152628
18	1x Ruler	525927
19	1x Weight, 5 kg, for linear drive	34065
20	2x Shock absorber	34572
	1x Connecting cable for linear potentiometer	376177
	1x Adapter for Y-axis or weight	167032
	1x Mounting accessories for position encoder	178441

Recommended accessories:

Aluminium profile plate → Page 238	
Compressor → Page 240	
Oscilloscope → Page 252	
Multimeter → Page 250	
Function generator	152918
Cable BNC – 4 mm	152919
Cable BNC – BNC	158357
T-connector BNC	159298
Tabletop power supply unit → Page 239	
Power supply unit for mounting frame → Page 239	
4 mm Safety laboratory cables → Page 247	

### Training aims

- Controlling pressure and position
- Action sequence of a control circuit
- Activity and timing of control units: discontinuous and continuous controls, P, I, D, PI, PD, PID controls, status controls
- Behaviour of control sequences: transfer characteristics, transient response, system with and without compensation, system of first, second and third order, idle times
- Interaction of closed-loop controls and control systems: control circuit optimisation, stability considerations
- Setup, commissioning and optimisation of closed-loop control assemblies, devices and systems with analogue controller cards

### Recommended training media

- WBT Pneumatics
- Design and simulation program, FluidSIM® Pneumatics

Also order:

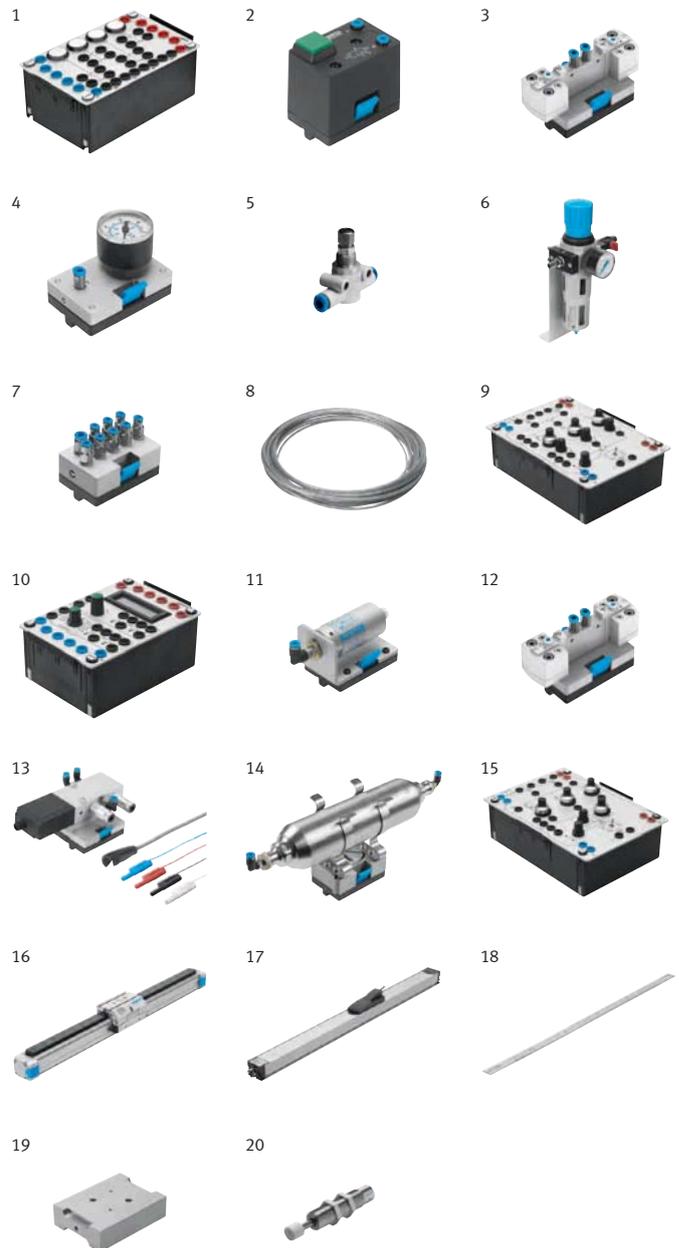
### Workbook Closed-loop pneumatics

Campus licence (→ Page 53):

de	<b>94459</b>
en	<b>94465</b>
es	<b>533499</b>
fr	<b>94347</b>

Partial equipment sets for controlling pressure and position on request.

Note: The linear drive and linear potentiometer are mounted perpendicular to the profile slot.



# Air Control System AirCS® equipment set – Advanced level

## Energy-efficient compressed air management



### A view of the entire system

Before compressed air can be used it must be generated, purified and distributed up to the respective application. Compressed air is a valuable form of energy. Nevertheless, too little is often done in order to lay out the overall system efficiently. Consumption is rarely measured or monitored. The cost situation is usually unclear.

This is where the Air Control System AirCS® comes in. The important aspects of making compressed air available and distributing it are examined within the framework of the AirCS® training project with regard to energy efficiency.

The AirCS® EduTrainer® serves as a basis to this end. It's incorporated between compressed air generation (compressor) and the process. In combination with FluidLab®-AirCS® software, integrated measuring technology allows for innovative condition monitoring for the measurement of compressed air and energy consumption.

### Generation and load management

The index number of the connected compressor is ascertained under the Condition Monitoring menu item. Various compressors can be compared and changes can be detected at an early stage. A calculation tool assists the user in ascertaining overall variable and fixed costs for compressed air generation.

In the case of load management, energy consumption is visualised for the compressor and an additional consuming device. Pressure thresholds are specified for switching the compressor on and off. In consideration of peak loads, the fundamentals of load management can then be imparted and tested.

As a prerequisite for the use of AirCS®, a system must be available for measurement, for example the MPS® distributing station or the equipment set TP 201 (basic level electro-pneumatics).

### Distribution and monitoring

Long-term monitoring makes it possible to visualise consumption for individual applications. This allows for well-founded statements regarding energy costs. Targeted and actual statuses can be compared, for example in order to be able to detect and evaluate leaks.

Compressed air distribution components can be examined in the Flow Resistance menu. In this way, for example, the various resistances of different tubing lengths and diameters can be acquired and compared, as well as for T-connectors and elbow connectors. Furthermore, a calculation tool is available for determining the ideal pipe cross-section.

In the case of nominal flow measurement, a second, external pressure sensor can be used to ascertain the nominal flow rates of devices and components, in a manner similar to the ISO 6358 standard.

### Special features of the AirCS® EduTrainer®

Pneumatic function area with:

- Flow sensor
- Pressure sensor
- Distributor block for QS-4/6/8
- Directly actuated 5/2-way solenoid valve
- Outlet with flow control valve and stop cock

Electrical function area with:

- Energy consumption meter
- 2x 230/110 V AC outputs with control technology to switch the 230/110 V AC consuming devices
- SysLink and analogue connection for EasyPort
- Connections for integrating the external sensor

Can be used for A4 mounting frame (399 x 297 mm) or as table stand.

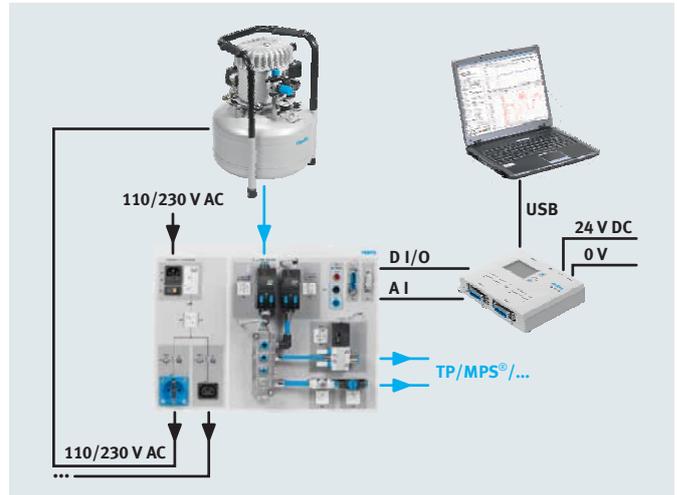
**Complete equipment set AirCS 8023858**

The most important components at a glance:

1x AirCS EduTrainer	8023859
1x AirCS accessory kit	8023860
1x FluidLab-AirCS 1.0 single licence	8023861
1x EasyPort USB	548687
1x Analogue cable, parallel, 2 m	529141
1x I/O data cable with SysLink connectors (IEEE 488) at both ends, 2.5 m	34031
1x Pressure sensor with display	572745

Necessary accessories, also order:

Compressor → Page 240
Tabletop power supply unit → Page 239
Power supply unit for mounting frame → Page 239
4 mm Safety laboratory cables → Page 247



**FluidLab®-AirCS® included**

The FluidLab®-AirCS® software is an important component of the AirCS® equipment set. Just a few simple steps are needed to configure the interface and select the user language (German/English). Then the exercises can be started.

Exercises are supported by connection diagrams, descriptions and sample solutions taken from the AirCS® workbook. The measurement process is software-controlled. Results can be measured with measuring points, printed out or exported to a spreadsheet program. The software scope also includes the complete book of exercises in PDF format.

**System requirements**

- PC with Windows XP/7/8
- CD-ROM drive
- USB 2.0 or serial interface

**AirCS® training documentation**

The workbook in German and English constitutes the accompanying documentation for the AirCS® training project.

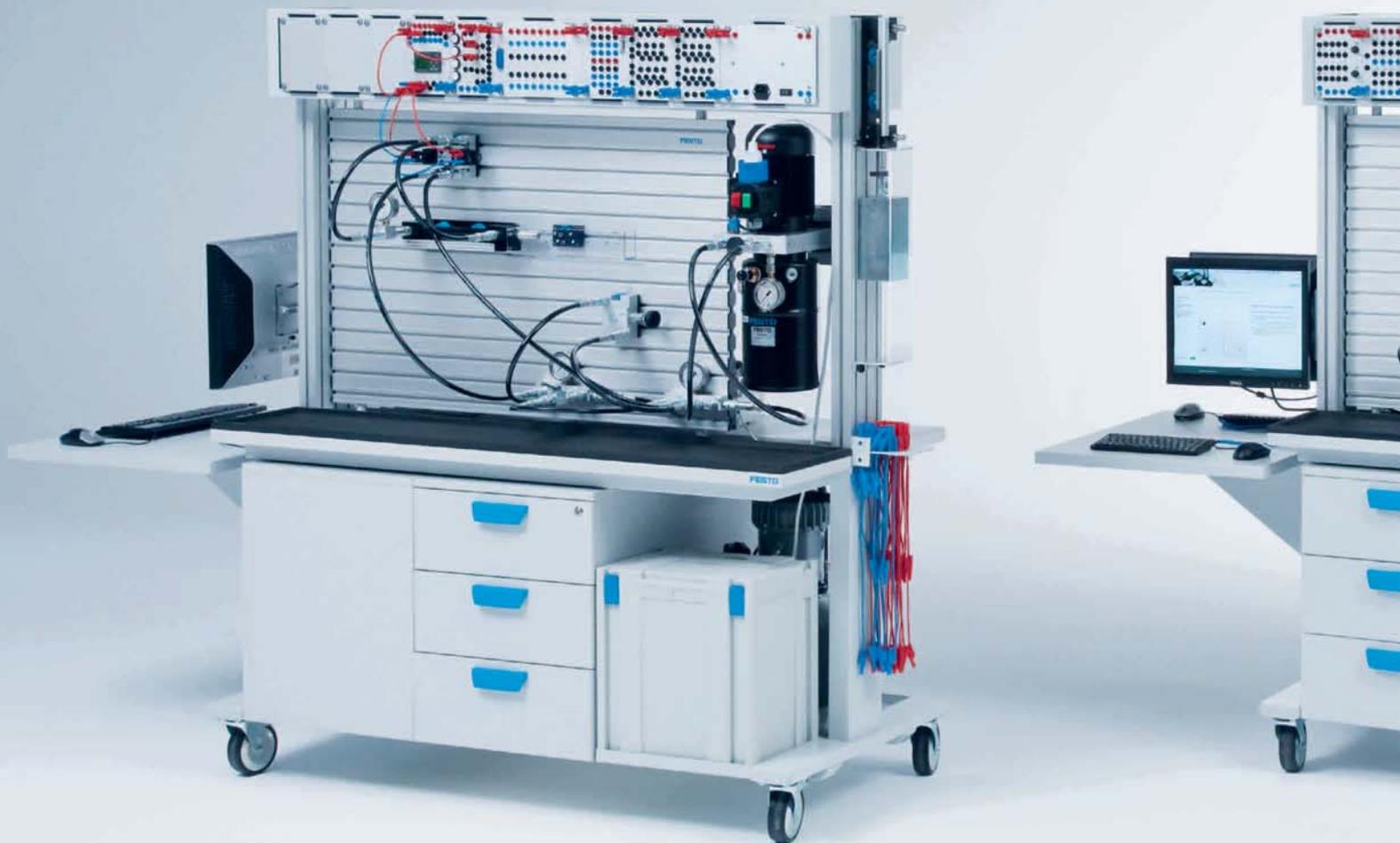
The workbook contains:

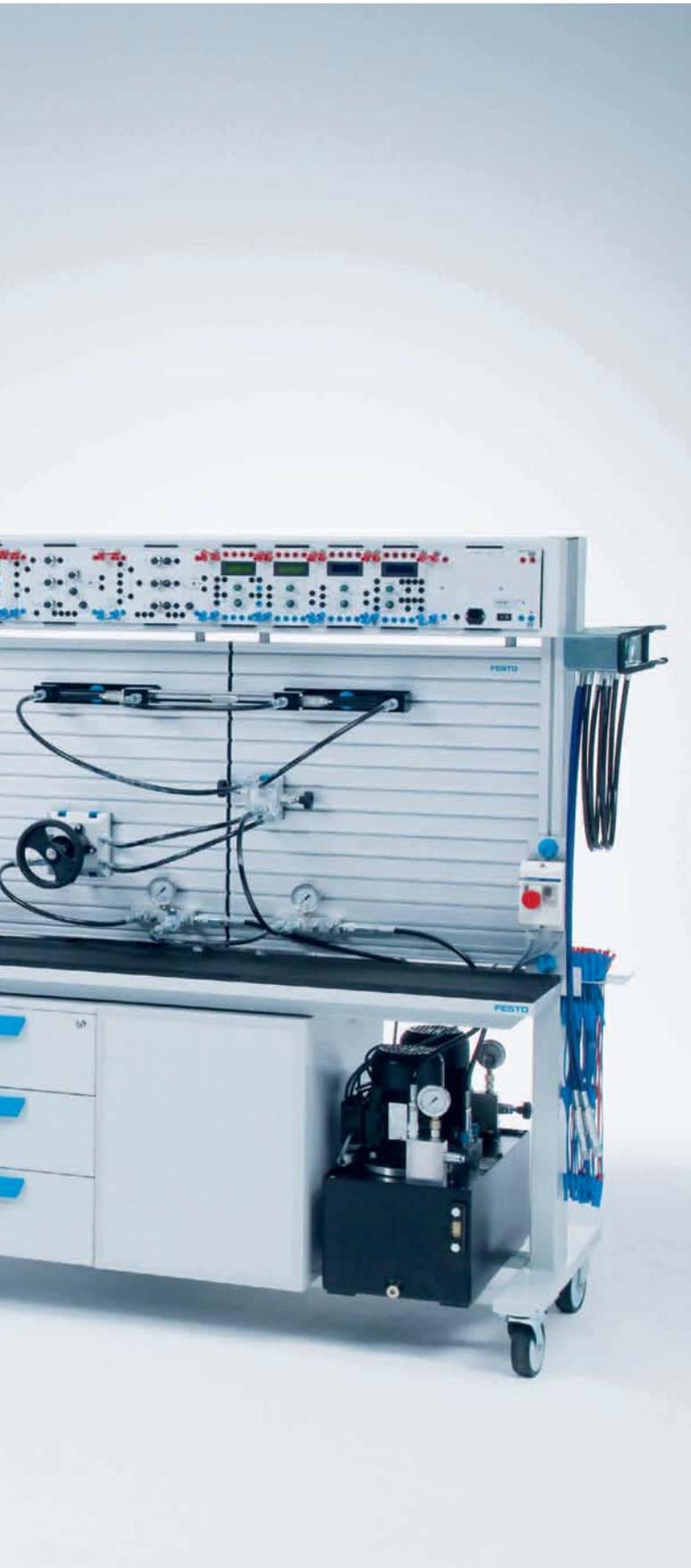
- Definition of task
- Sample solutions
- Training notes

Up to two electric consuming devices (e.g. compressor and power supply unit) are needed to perform the load management exercises.



## Hydraulics training packages





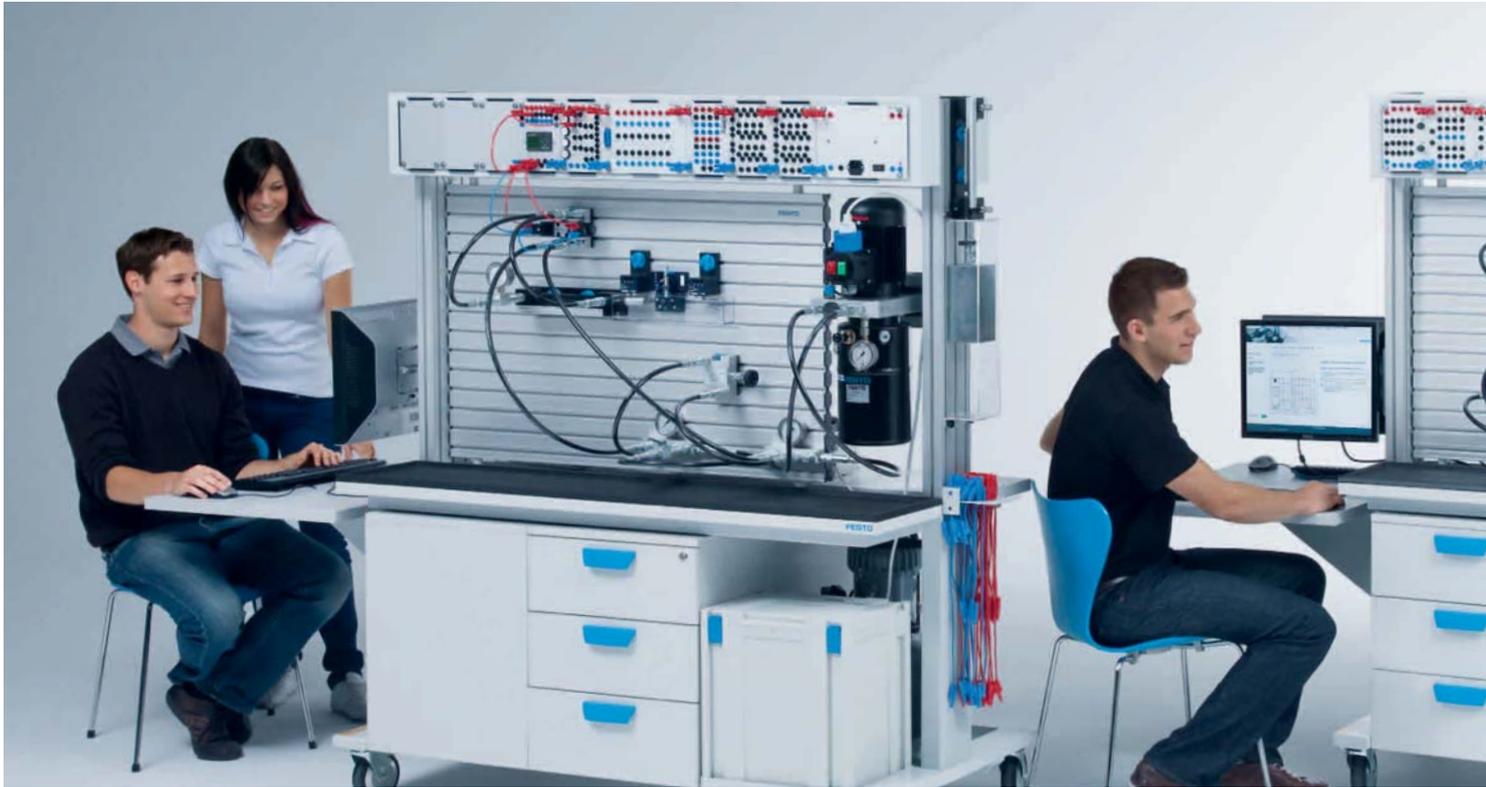
System description ..... 132

**Equipment sets**

Hydraulics ..... 134  
 Electrohydraulics ..... 138  
 Measurement and control ..... 144  
 Proportional hydraulics ..... 146  
 Closed-loop hydraulics ..... 150  
 BIBB hydraulics ..... 152  
 Mobile hydraulics ..... 153

# Hydraulics training packages

## Tailored training in industrial and mobile hydraulics



### Modular for flexible expansion

Festo Didactic's training packages are modular in structure. For example, you could start with the basic level of electrohydraulics and then move onto the advanced level. Or are you more interested in electropneumatics? The choice is yours. You'd like to explore a particular specialised 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 or on the profile column of a Learnline workstation. The electrical units are clamped into the ER frame and sequenced individually. The supports and the electrical units are the same for both hydraulics and pneumatics – a single investment, with double the 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 it – power!

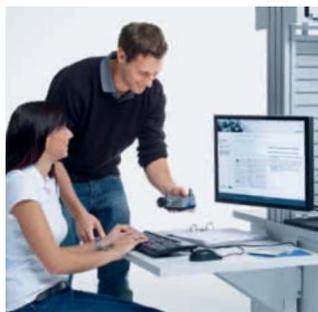
Hydraulic power is supplied by the tool-free connection of low-leakage couplings – the latest generation in high-grade stainless steel. The coupling is self-sealing when uncoupled. During the low-friction coupling procedure, only the front surface is coated with oil, which saves resources, is easy on the environment, and reduces contamination.



**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 hydraulics, the training also covers basic physics, technical calculations, safety, efficiency, analytical fault-finding and professional documentation.

Practical basic and further 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 hydraulic 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®
- Practical implementation with the training packages and the exercises in the workbooks
- Functional testing and optimisation with measurement technology and FluidLab®



**Quality not quantity!**

Bigger is not necessarily better. Volumetric flow rates and pressures should be chosen with care and in co-ordination with the system as a whole. This applies especially to hydraulic training systems. High forces and cylinder speeds not only increase the danger for the user, but also require a larger hydraulic power pack with higher power consumption. So our offer is: as large as necessary and as small as possible, without compromising on teaching effectiveness.



**New technologies – new skills needed**

Modern measurement and diagnostic technology and cartridge valves are among the international trends in hydraulics. So you'll find those technologies in our learning systems as well. Benefit from the compact, integrated design, the low weight, ease of handling, and easy-to-read symbol system.

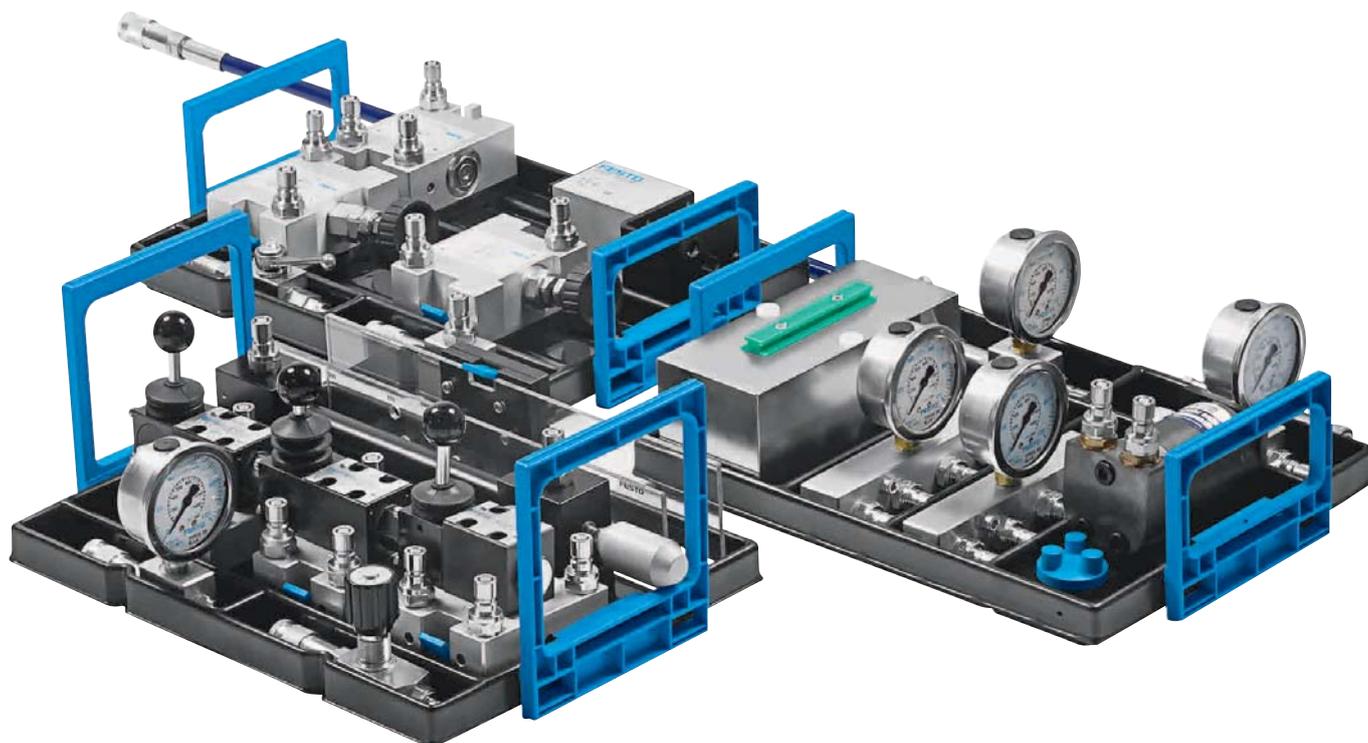


**Mobile hydraulics**

The new training packages for mobile hydraulics systematically and informatively explore complex topics and systems, such as work hydraulics, hydrostatic steering and drive systems for the agricultural, forestry and construction vehicle sectors and warehouse and municipal vehicles.

## Equipment set TP 501 – Basic Level

### Basic training in hydraulics



#### The classic reissued

The solid basis for practical basic and further education. Training package TP 501 contains only purely hydraulic control systems.

The number and version of the components are specifically adapted to the projects in the workbook. This is a cost-effective way of achieving the important training objectives.

TP 501, Basic Level is suitable for basic training in hydraulic control technology and imparts knowledge of the basic physical principles of hydraulics, as well as the function and use of hydraulic components.

#### Pure convenience

- Easy and exact switching of hand lever valves
- Simple and precise setting of the flow and pressure valves thanks to the ergonomic handwheels and the fine resolution
- Tool-free, single-hand operation with quick action mounting system Quick-Fix®
- Easy and secure plugging and releasing of the new, low-leakage, self-sealing quick connection couplings

Delivered in practical, Systainer-compatible equipment trays. The trays, in turn, fit exactly into the drawers in Learnline workstations.

#### Training content

Power packs and components:

- Design, function and most important characteristics of a hydraulic power unit
- Design and function of pressure-relief valves, cylinders and directional control valves
- Design and function of the non-return valve, one-way flow control valve and piloted non-return valve
- Design and function of flow control valves

Measurements and calculations:

- Recording and interpreting the characteristic curve of a hydraulic pump
- Measuring the volume flow of a hydraulic control system
- Recording the characteristic curve of a pressure-relief valve
- Identifying and calculating times, pressures and forces during advancing and retracting of a cylinder
- Recording the characteristic curve of a flow control valve
- Calculating performance ratios when using 4/3-way valves with different mid-positions

Hydraulic circuits:

- Commissioning hydraulic circuits safely
- Using the flow control valve in the inflow and outflow and adjusting the drive speed
- Difference between a flow control valve and one-way flow control valve in hydraulic control systems
- Design and mode of operation of a differential circuit
- Effect of the piston surfaces on pressures, forces, speeds and travel times
- Proper use of piloted non-return valves
- Circuits with different types of counter pressure
- Operating cylinders with varying loads

**Complete equipment set TP 501 in equipment tray 573035**

The most important components at a glance:

1	1x Pressure relief valve	544335
2	1x 2-way flow control valve	544338
3	1x One-way flow control valve	152843
4	1x Non-return valve, delockable	544339
5	1x Non-return valve, 0.6 MPa opening pressure	548618
6	1x 4/2-way hand lever valve, spring return	544342
7	1x 4/3-way hand lever valve, relieving mid-position (AB → T), detenting	544344
8	1x 4/3-way hand lever valve, closed mid-position, detenting	544343
9	1x Shut-off valve	152844
10	1x Differential cylinder 16/10/200 with cover	572746
11	1x Weight, 9 kg for cylinder	152972
12	1x Hydraulic motor	152858
13	1x T-distributor	152847
14	2x 4-way distributor with pressure gauge	159395
15	3x Pressure gauge	152841
16	1x Flow sensor	567191

Necessary accessories, also order:

7x	Hose line with quick release couplings, 600 mm	152960
3x	Hose line with quick release couplings, 1000 mm	152970
2x	Hose line with quick release couplings, 1500 mm	159386
	Multimeter → Page 250	
	Aluminium profile plate → Page 238	
	Hydraulic power pack → Pages 244 – 245	
	Protective cover for weight, 9 kg → Page 242	
	Power supply unit for mounting frame → Page 239	

Also order:

**Workbook**



The basic circuits for hydraulics are presented in 17 exercises. The symbols used in the circuit diagrams are according to DIN/ISO 1219. In order to carry out the exercises, students require the equipment set for TP 501 Hydraulics, Basic Level.

The workbook contains:

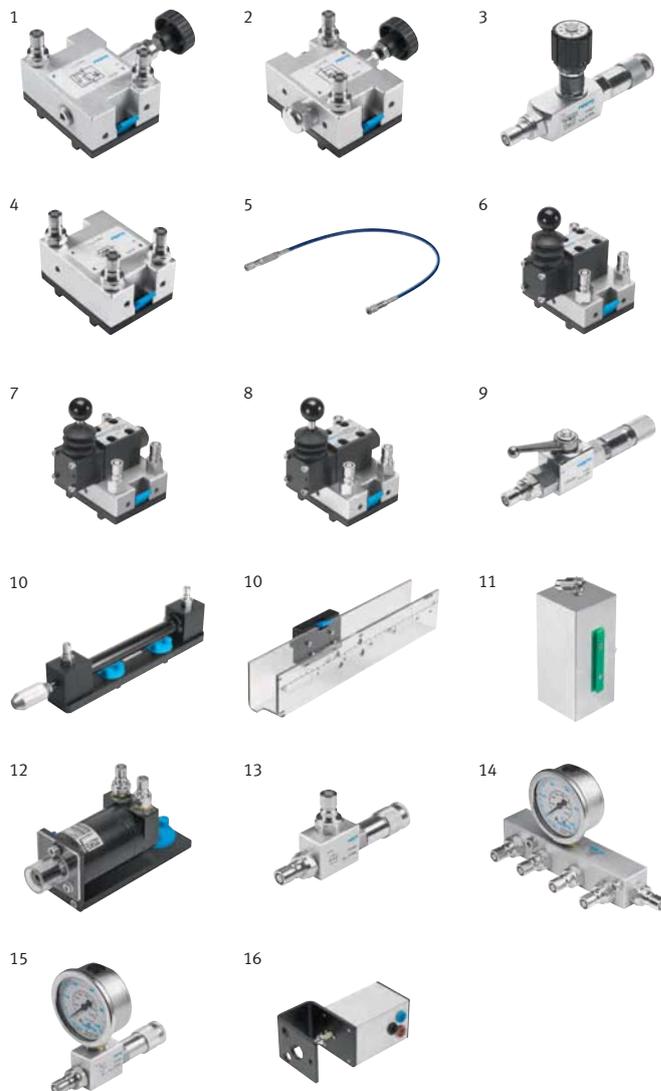
- Sample solutions
- Training notes
- Multimedia CD-ROM with graphics, photos of industrial applications, animations and FluidSIM® circuit diagrams
- Worksheets for students

Campus licence (→ Page 53):

de	550141
en	551141
es	551145
fr	551146

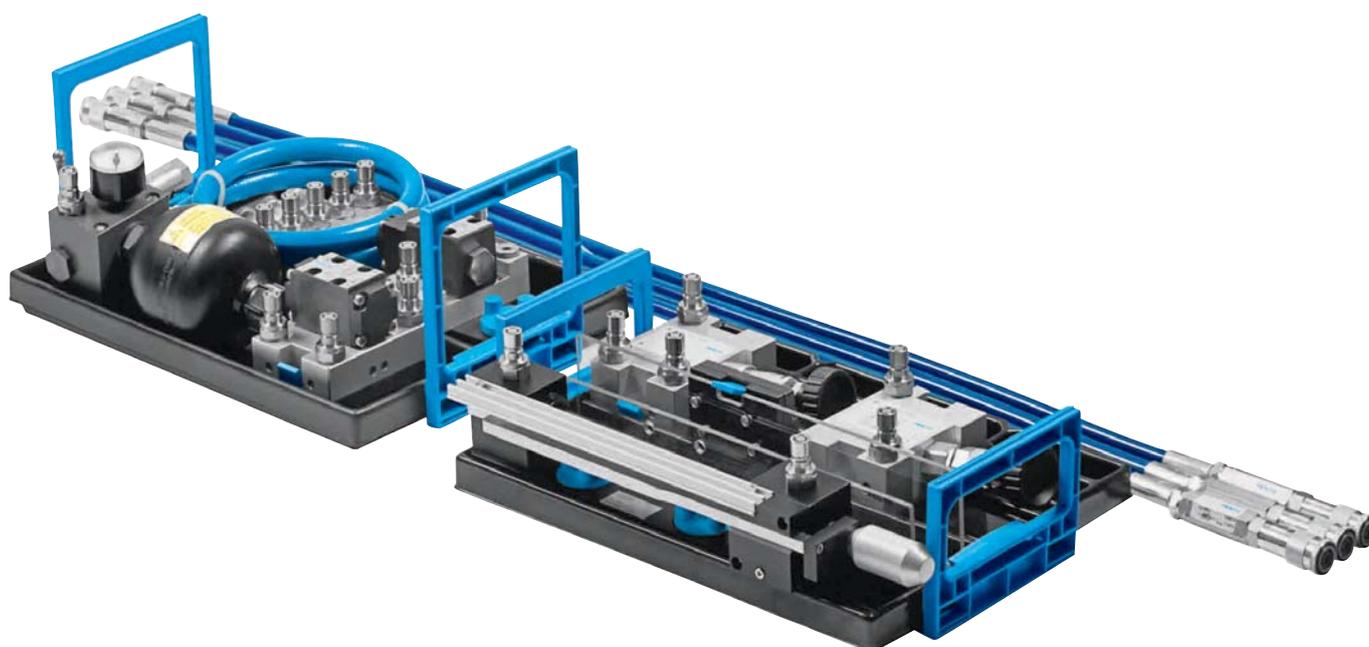
**Supplementary media**

- Designing and simulating with FluidSIM®
- Measuring and controlling with FluidLab®
- WBT Hydraulics
- Textbook Basic principles of Hydraulics and Electrohydraulics
- Hydraulics poster set



# Equipment set TP 502 – Advanced Level

## Hydraulics for advanced users



### The new advanced level

The training package TP 502 builds on the material covered in training package TP 501 – Basic Level, and adds 15 new projects to it.

The course expands students' knowledge about the basic physical principles of hydraulics and the function and use of further hydraulic components.

In order to carry out the projects, users require the components and the necessary accessories from equipment set TP 501.

### Hydraulics plus!

The new components provide added training value and relevant project tasks form the basis for advanced training in fundamental principles.

Delivered in practical, Systainer-compatible equipment trays. These trays, in turn, fit exactly into the drawers in Learnline workstations.

### Training content

Power packs and components:

- Design and function of a hydraulic motor
- Setting the direction and speed of rotation of a hydraulic motor
- Design, function and use of a flow divider
- Using a hydraulic reservoir as a volume and pressure accumulator
- Design, function and use of a pressure regulator
- Specifying the cylinder pressure
- Difference between pressure-relief valves and pressure regulators

Measurements and calculations:

- Calculating performance ratios of hydraulic circuits from measured values
- Calculating forces on the cylinder
- Creating procedure descriptions

Hydraulic circuits:

- Implementing bypass circuits
- Ensuring synchronised forward and return strokes
- Getting to know the bypass circuit
- Getting to know the rapid traverse feed circuit
- Advancing and retracting of a cylinder after the pump from the reservoir is switched off
- Use of a hydraulic reservoir for a rapid traverse circuit
- Getting to know the rectifier circuit
- Configuration and description of a sequence control with two cylinders
- Getting to know the pressure sequence and pressure stage circuit
- Getting to know the fuse protection for tensile loads

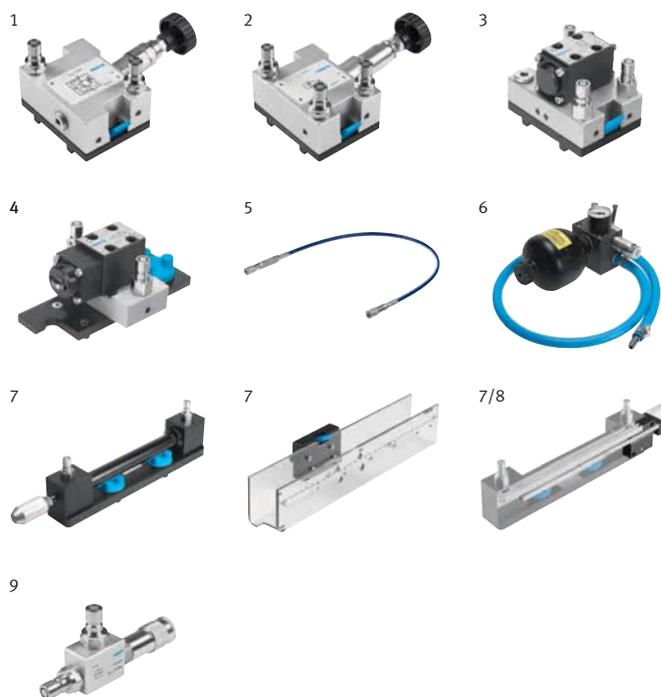
**Complete equipment set TP 502 in equipment tray 573036**

The most important components at a glance:

1	1x Pressure relief valve, compensated	567237
2	1x 3-way pressure reducing valve	544337
3	1x Flow dividing valve	544340
4	1x 2/2-way stem actuated valve, convertible	544353
5	3x Non-return valve, 0.6 MPa opening pressure	548618
6	1x Diaphragm accumulator with shut-off block	152859
7	1x Differential cylinder 16/10/200 with cover	572746
8	1x Mounting kit for cylinders	544371
9	5x T-distributor	152847

Necessary accessories, also order:

7x	Hose line with quick release couplings, 600 mm	152960
4x	Hose line with quick release couplings, 1000 mm	152970
2x	Hose line with quick release couplings, 1500 mm	159386
	4 mm Safety laboratory cables → Page 247	
	Multimeter → Page 250	
	Aluminium profile plate → Page 238	
	Hydraulic power pack → Pages 244 – 245	
	Protective cover for weight, 9 kg → Page 242	
	Power supply unit for mounting frame → Page 239	



Also order:

**Workbook**



The tasks explain further hydraulic circuits. The equipment set of package TP 501 – Hydraulics Basic Level and TP 502 – Advanced Level equipment set are needed to carry out the tasks.

The workbook contains:

- Sample solutions
- Training notes
- Multimedia CD-ROM with graphics, photos of industrial applications, animations and FluidSIM® circuit diagrams
- Worksheets for students

Campus licence (→ Page 53):

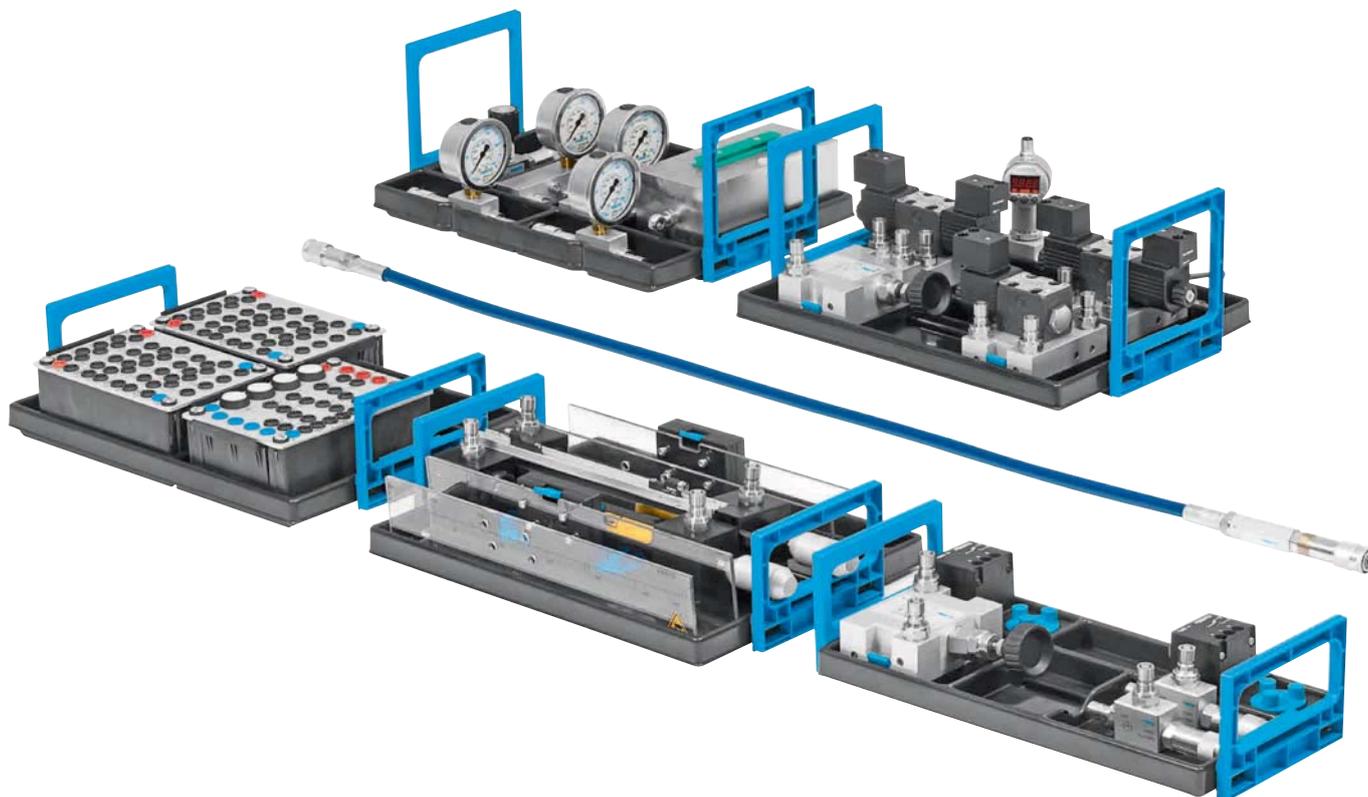
de	550142
en	551147
es	551148
fr	551149

**Supplementary media**

- Designing and simulating with FluidSIM®
- Measuring and controlling with FluidLab®
- WBT Hydraulics
- Textbook Basic principles of Hydraulics and Electrohydraulics
- Hydraulics poster set

# Equipment set TP 601 – Basic Level

## Basic training in electrohydraulics



### New edition of electrohydraulics!

TP 601 is a logical further development of electrohydraulics for training and further education. The equipment set contains only electrohydraulic circuits and control systems.

The number and version of the components are specifically adapted to the projects in the workbook. This is a cost-effective way of teaching the important training objectives.

This equipment set provides students with knowledge about the basic physical principles of electrical engineering and electrohydraulics, as well as how electrohydraulic and control technology components function and are used.

### Training content

#### Power packs and components:

- Design, mode of operation and areas of application of 2/2, 3/2, 4/2 and 4/3-way solenoid valves, as well as 4/2-way double solenoid valves
- Design and mode of operation of electrical pushbuttons, switches and limit switches
- Design and mode of operation of a relay
- Knowing and accounting for the contact load capacity of electrical signal transmitters
- Selecting and using hydraulic and electrical components according to economic criteria
- Design and mode of operation of a pressure switch
- Knowing different ways of sensing a cylinder's end position and selecting the right one

#### Hydraulic circuits:

- Commissioning hydraulic circuits safely
- Explaining and designing direct and indirect actuation
- Creating and using a sequence table
- Explaining and designing signal storage in the hydraulic power section
- Selecting solenoid valves according to the technical control requirements
- Using and designing basic logic functions
- Explaining and designing an electric latching circuit with a dominant switch-off signal
- Designing and arranging pressure-dependent control systems
- Knowing simple operating modes and accounting for them in the circuit
- Electrically and mechanically locking of signals in a relay control system

- Expanding existing control systems and adjusting the documentation accordingly
- Implementing sequence control with two cylinders
- Getting to know and creating a procedure description as GRAFCET and as a function diagram
- Analysing circuits and carrying out systematic fault finding and error elimination with restart

#### Measurements and calculations:

- Measuring and calculating the flow in an electrohydraulic installation
- Calculating electrical characteristic values

**Complete equipment set TP 601 in equipment tray 573037**

The most important components at a glance:

1	1x Pressure relief valve	544335
2	1x 2-way flow control valve	544338
3	1x One-way flow control valve	152843
4	1x Non-return valve, 0.6 MPa opening pressure	548618
5	1x 4/2-way solenoid valve, spring return	544346
6	1x 4/3-way solenoid valve, closed mid-position	544347
7	1x 4/2-way double solenoid valve, detenting	544352
8	1x Shut-off valve	152844
9	1x Weight, 9 kg, for cylinder	152972
10	2x Differential cylinder 16/10/200 with cover	572746
11	1x Mounting kit for cylinders	544371
12	2x T-distributor	152847
13	2x 4-way distributor with pressure gauge	159395
14	2x Pressure gauge	152841
15	1x Pressure switch, electronic	548612
16	2x Relay, three-fold	162241
17	1x Signal input, electrical	162242
18	1x Limit switch, electrical, left-actuated	183322
19	1x Limit switch, electrical, right-actuated	183345
20	2x Proximity sensor, electronic	2342009

Necessary accessories, also order:

7x	Hose line with quick release couplings, 600 mm	152960
2x	Hose line with quick release couplings, 1000 mm	152970
4x	Hose line with quick release couplings, 1500 mm	159386
4 mm Safety laboratory cables → Page 247		
Multimeter → Page 250		
Aluminium profile plate → Page 238		
Hydraulic power pack → Pages 244 – 245		
Protective cover for weight, 9 kg → Page 242		
Tabletop power supply unit → Page 239		
Power supply unit for mounting frame → Page 239		

Also order:

**Workbook**



The basic electric circuits for hydraulic control technology are presented in 15 exercises. In order to carry out the exercises, students require the equipment set of TP 601 Electrohydraulics, Basic Level.

The workbook contains:

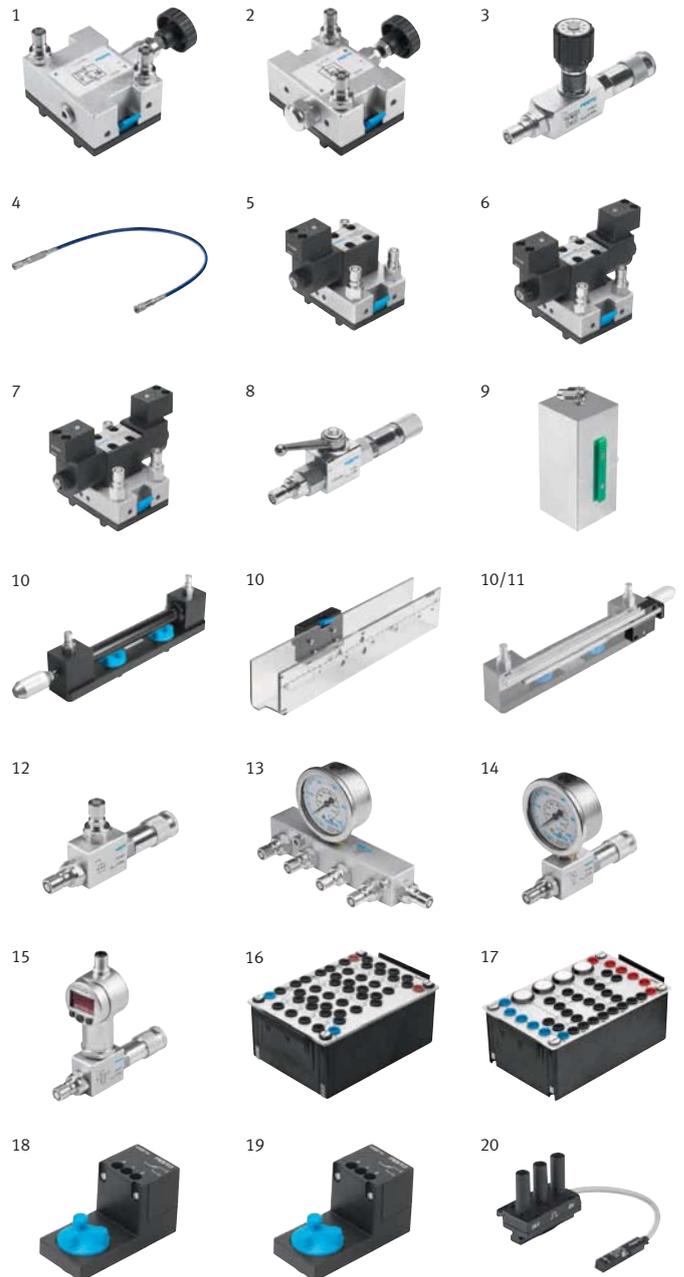
- Sample solutions
- Training notes
- Multimedia CD-ROM with graphics, photos of industrial applications, animations and FluidSIM® circuit diagrams
- Worksheets for students

Campus licence (→ Page 53):

de	550143
en	551150
es	551151
fr	551152

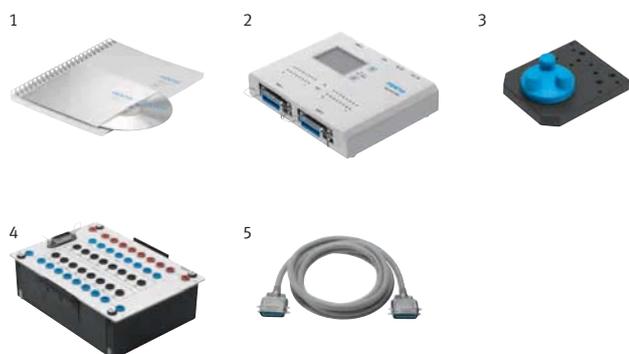
**Supplementary media**

- Designing and simulating with FluidSIM®
- Measuring and controlling with FluidLab®
- WBT Electrohydraulics
- Textbook Basic principles of Hydraulics and Electrohydraulics
- Hydraulics poster set



# Supplementary equipment sets

## Controllers for electrohydraulics



### Supplementary equipment set Controlling using FluidSIM®/ EasyPort USB

With this package, the FluidSIM® software can be used to control training packages. FluidSIM® controls via EasyPort USB and processes the inputs and outputs connected to the universal connection unit according to their programming, e.g. using the digital module contained in FluidSIM®.

The Controlling using FluidSIM® package contains everything you need to control training packages TP 201 and TP 601. FluidSIM® Pneumatics is required for TP 201 and FluidSIM® Hydraulics for TP 601. A set of brief instructions provides information on the individual steps.

The sample solutions are included on a data storage medium as FluidSIM® CT programs.

Complete supplementary equipment set Controlling using FluidSIM®/EasyPort USB in equipment tray	<b>556270</b>
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The most important components at a glance:

1	1x Brief instructions for FluidSIM, de/en/es/fr	556267
2	1x EasyPort USB	548687
3	1x Quick-Fix screw adapter	549806
4	1x Universal connection unit, digital (SysLink)	162231
5	1x I/O data cable with SysLink connectors (IEEE 488) at both ends, 2.5 m	34031

Prerequisite:

Equipment set TP 601 – Basic Level → Pages 138 – 139
FluidSIM Hydraulics → Pages 36 – 37

Necessary accessories, also order:

Aluminium profile plate → Page 238
Hydraulic power pack → Pages 244 – 245
Power supply unit for mounting frame → Page 239
4 mm Safety laboratory cables → Page 247

# Supplementary equipment sets

## Electrohydraulics

### Supplementary equipment set from Hydraulics, Basic level TP 501 to Electrohydraulics, Basic level TP 601

For training aims see Electrohydraulics, Basic level TP 601 equipment set.

Complete supplementary equipment set TP 501 – TP 601 **573039**

The most important components at a glance:

1	2x Relay, three-fold	162241
2	1x Signal input, electrical	162242
3	1x Limit switch, electrical, left-actuated	183322
4	1x Limit switch, electrical, right-actuated	183345
5	1x 4/2-way double solenoid valve, detenting	544352
6	1x 4/2-way solenoid valve, spring return	544346
7	1x 4/3-way solenoid valve, closed mid-position	544347
8	1x Differential cylinder 16/10/200 with cover	572746
9	1x Mounting kit for cylinders	544371
10	1x Pressure switch, electronic	548612
11	2x Proximity sensor, electronic	2342009
12	1x T-distributor	152847

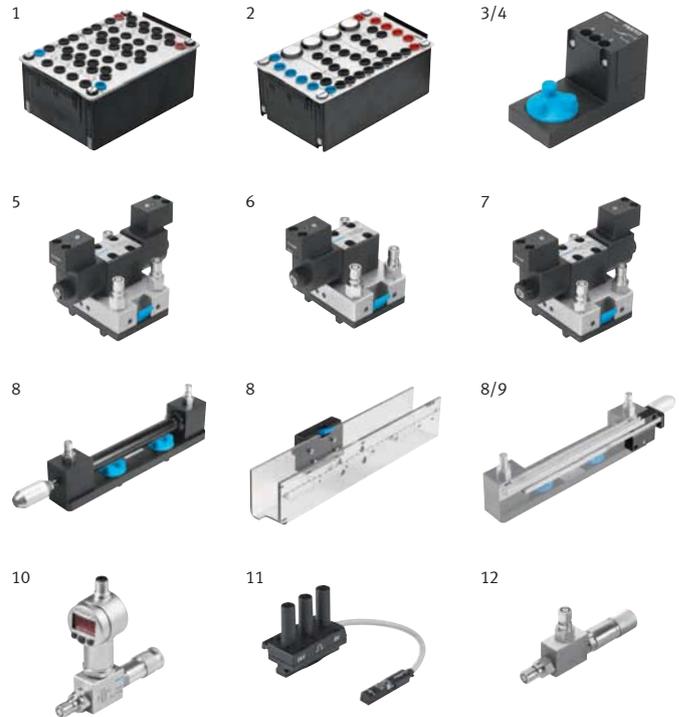
### Supplementary equipment set from Hydraulics, Basic level TP 501 and Advanced level TP 502 to Electrohydraulics, Basic level TP 601

For training aims see Electrohydraulics, Basic level TP 601 equipment set.

Complete supplementary equipment set TP 501 and TP 502 – TP 601 **573040**

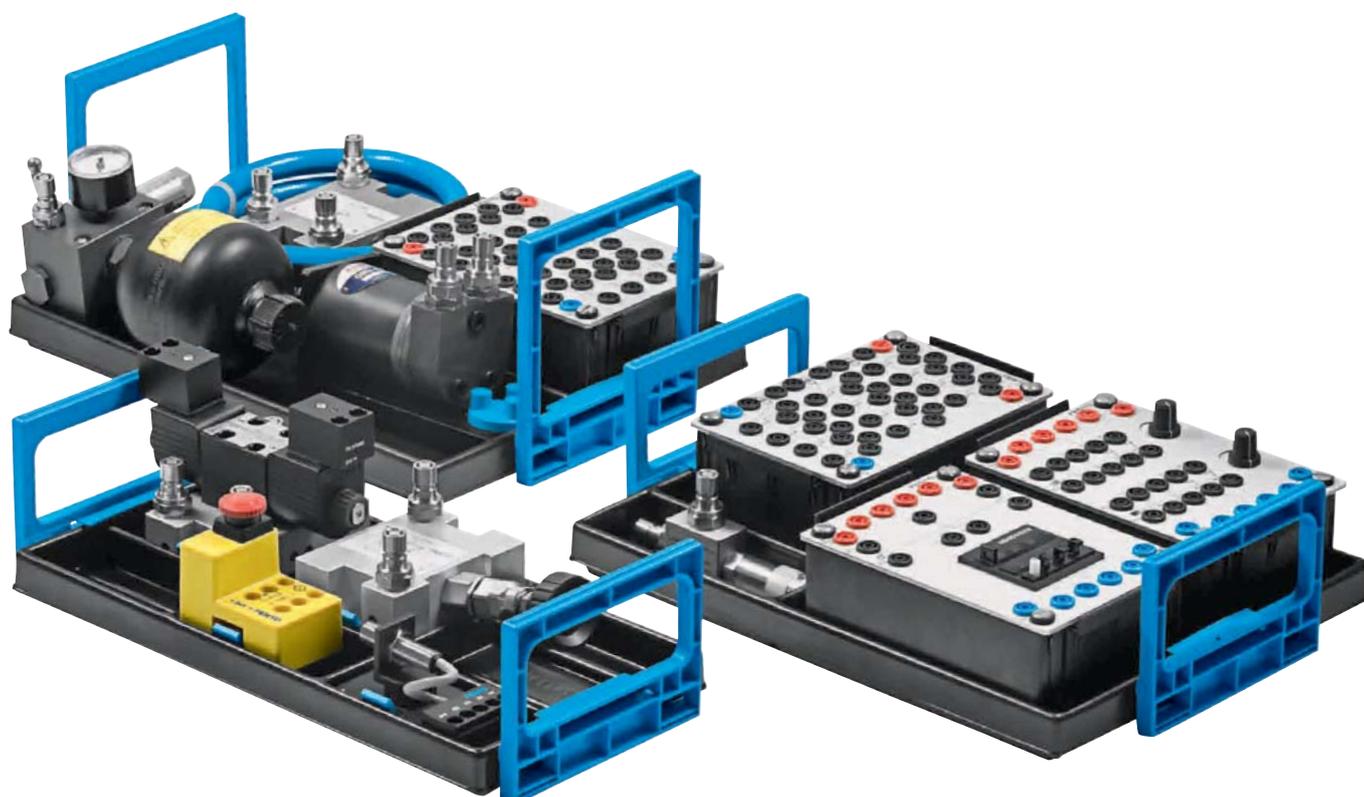
The most important components at a glance:

1	2x Relay, three-fold	162241
2	1x Signal input, electrical	162242
3	1x Limit switch, electrical, left-actuated	183322
4	1x Limit switch, electrical, right-actuated	183345
5	1x 4/2-way double solenoid valve, detenting	544352
6	1x 4/2-way solenoid valve, spring return	544346
7	1x 4/3-way solenoid valve, closed mid-position	544347
10	1x Pressure switch, electronic	548612
11	2x Proximity sensor, electronic	2342009



# Equipment set TP 602 – Advanced Level

## Electrohydraulics for advanced students



### The new advanced level

The training package TP 602 builds directly on the material covered in basic principles package TP 601, and adds more in-depth projects to it.

It provides students with advanced knowledge about the basic physical principles of electrical engineering and electrohydraulics, as well as how electrohydraulic and control technology components function and are used.

In order to carry out the projects, users require the components and the necessary accessories from TP 601.

The number and version of the components are specifically adapted to the projects in the workbook. This makes it possible to achieve many important training objectives at little cost.

### Training content

Power packs and components:

- Design and mode of operation of different proximity sensors
- Function and possible applications of a time relay with switch-on and switch-off delay
- Design and use of an electrical predetermining counter

Learning objectives for hydraulic circuits:

- Selecting proximity sensors according to the technical control requirements
- Expanding electrohydraulic control systems and adjusting the documentation
- Designing and arranging path- and pressure-dependent sequence controls
- Identifying signal overlaps in a sequence control and taking the appropriate action
- Designing and arranging sequence control as a standing sequencer

- Using memory to implement an emergency operation
- Implementing control systems with the operating modes single cycle and continuous cycle
- Querying time in electrohydraulic control systems
- Getting to know and using further logical connections
- Designing and arranging pressure sequence control
- Knowing safety-related conditions that could be needed for a drive
- Designing and arranging safety functions with a predefined motion sequence for a control system
- Implementing control systems with the operating modes inching and aligning
- Systematically identifying and eliminating errors in complex electrohydraulic control systems
- Creating sequence control as a displacement-step diagram
- Representing procedure descriptions with GRAFCET

### Hydraulics plus!

Delivered in practical, Systainer-compatible equipment trays. The trays fit into the drawers in Learnline workstations. The new components, with added training value and relevant project tasks, form the basis for advanced training in fundamental principles.

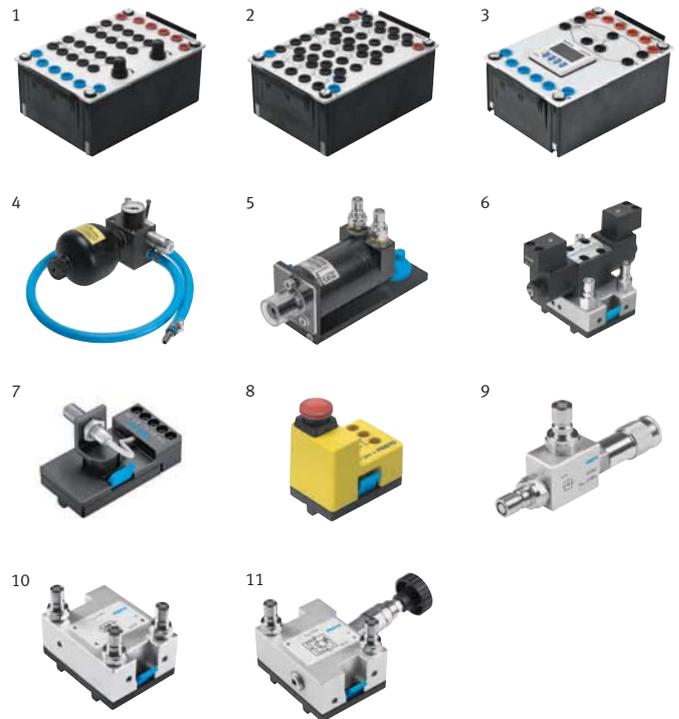
**Complete equipment set TP 602 in equipment tray 573038**

The most important components at a glance:

1	1x Time relay, two-fold	162243
2	2x Relay, three-fold	162241
3	1x Preset counter, electronic	1677856
4	1x Diaphragm accumulator with shut-off block	152859
5	1x Hydraulic motor	152858
6	1x 4/3-way solenoid valve, relieving mid-position (AB -> T)	544348
7	1x Proximity sensor, inductive, M12	548643
8	1x Emergency stop pushbutton, electrical	183347
9	1x T-distributor	152847
10	1x Non-return valve, delockable	544339
11	1x Pressure relief valve, compensated	567237

Necessary accessories, also order:

8x	Hose line with quick release couplings, 600 mm	152960
4x	Hose line with quick release couplings, 1000 mm	152970
2x	Hose line with quick release couplings, 1500 mm	159386
	4 mm Safety laboratory cables → Page 247	
	Multimeter → Page 250	
	Aluminium profile plate → Page 238	
	Hydraulic power pack → Pages 244 – 245	
	Protective cover for weight, 9 kg → Page 242	
	Tabletop power supply unit → Page 239	
	Power supply unit for mounting frame → Page 239	



Also order:

**Workbook**



The basic practical circuits in electrohydraulics are presented in 12 exercises. In order to carry out the exercises, students require the equipment set of TP 601 Electrohydraulics, Basic Level and Advanced Level TP 602.

The workbook contains:

- Sample solutions
- Training notes
- Multimedia CD-ROM with graphics, photos of industrial applications, animations and FluidSIM® circuit diagrams
- Worksheets for students

Campus licence (→ Page 53):

de	550144
en	551153
es	551154
fr	551155

**Supplementary media**

- Designing and simulating with FluidSIM®
- Measuring and controlling with FluidLab®
- WBT Hydraulics
- WBT Electrohydraulics
- Textbook Basic principles of Hydraulics and Electrohydraulics
- Hydraulics poster set

## Equipment set TP 610 – Advanced level

### Measurement and control in Hydraulics with FluidLab®-H



#### Fit for tomorrow?

The equipment set for TP 610 expands the training content of TP 501 and TP 601 to include the topic of hydraulics measurement and control. The material covered ranges from recording simple characteristic curves of individual hydraulic valves through to the basic principles of cylinder control. In addition, awareness is raised in a clear and striking manner about the effective use of hydraulic energy, e.g. with resistance experiments.

New features of FluidLab®-H include the measurement experiments for proportional technology with recording characteristic curves and applications such as pressure stages and rapid traverse feed circuits, as well as control technology with position, sequence and pressure control.

Exercises for the measurement and analysis of system and control behaviour point to a future in which diagnostics, preventative maintenance and saving energy are becoming more and more important.

#### Something extra special

In order to complete the exercises, sensors (e.g. pressure, flow and position) are connected to the inputs and control signals are transmitted to the EasyPort USB outputs. The FluidLab®-H software included in the scope of delivery interprets and visualises the signals. Analogue values are displayed as measurement curves.

Each exercise includes notes on its implementation, with positional sketches and block circuit diagrams. Students are guided step by step through the experiments. Measured results are then interpreted, compared with sample solutions and questions are asked to check students' understanding.

#### Training content

- Basic principles of analogue processing
- Using and adjusting sensors
- Interpreting measurement results
- Reading and understanding technical data and measurement curves
- Getting to know fluid engineering components and their influence and function
- Demonstrating fluid engineering effects and special features
- Analytical fault finding
- Hydraulic energy
- Evaluating changes of state
- Proportional technology
- Control technology with position, sequence and pressure control

#### Your advantages

- Fast, PC-supported recording of measured values
- Greater training success through measurement of components and interpretation of results
- Sensors that enable students “to look into” the circuit and components
- Suppositions regarding system behaviour can be easily proven
- Learning the principles of measurement and analysis and applying them directly in other circuits
- Demonstrate and understand the principles of fluid engineering faster
- System analysis via a PC: State-of-the-art diagnostic method
- Better understanding of fluid engineering components and processes and thus better training outcomes

**Complete equipment set TP 610 in equipment tray 567194**

The most important components at a glance:

1	1x I/O data cable with SysLink connectors (IEEE 488) at both ends, 2.5 m	34031
2	1x Universal connection unit, digital (SysLink)	162231
3	1x Analogue cable, parallel, 2 m	529141
4	1x Connection unit, analogue	567232
5	1x EasyPort USB	548687
6	1x Quick-Fix screw adapter	549806
7	1x 4/3-way solenoid valve, relieving mid-position (AB → T)	544348
8	2x Pressure sensor	525964
9	1x Flow control valve	152842
10	1x Resistance hose line with quick release couplings, 1000 mm	549858
11	1x FluidLab-H Single licence, de/en	573286
12	1x Limit switch, electrical, left-actuated	183322

The exercises for proportional and control hydraulics also require:

Proportional amplifier	162255
Displacement encoder for cylinder, 200 mm stroke	167090
Mounting kit for cylinders	544371
4/3-way proportional valve	167086
Proportional pressure relief valve	544351
Pressure filter	548609

Optionally, the regulating valve can be used instead of the proportional amplifier with the proportional valves for the control technology exercises.

4/3-way regulating valve	567269
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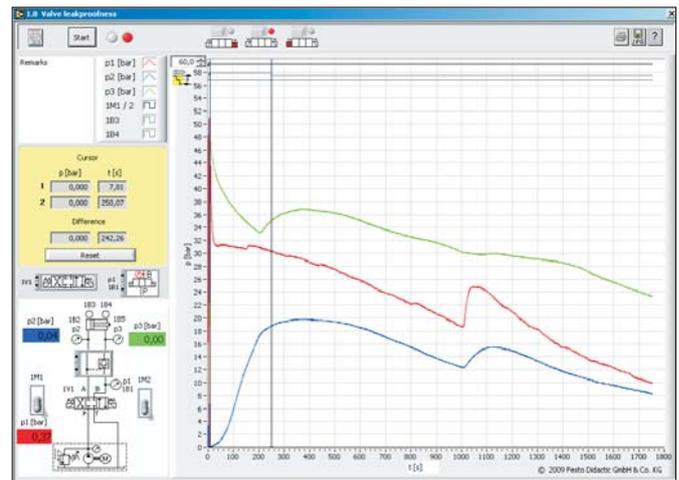
**Includes FluidLab®-H measurement software**

The FluidLab®-H software is an important component of the training package TP 610. Just a few simple steps are needed to configure the interface, adapt the sensors and select the language (de/en). Then the exercises can begin. These are divided into the areas: basic experiments, cylinder controls, proportional technology and control engineering. Connection diagrams, descriptions and sample solutions support students during the exercises. The software also controls the measurement sequence. Diagrams can be dimensioned and printed out using the cursors. The software also includes the complete book of exercises, with sample solutions, in PDF format.

**System requirements**

- PC with Windows XP/7/8
- Pentium® III or equivalently
- 2 GB RAM
- CD-ROM disk drive
- USB 2.0 or serial interface
- 1280 x 1024 pixels
- NI LabView 2012 Runtime (included in scope of delivery)

To carry out the exercises, students require the components and appropriate accessories from training packages 501 and 601.



# Equipment set TP 701 – Basic level

## Basic proportional hydraulics training



### Proportional hydraulics, Basic Level

Proportional valves are continuous valves that, thanks to proportional magnets, not only permit simple switching positions, but also enable a continuous transition in the valve opening.

These valves are specifically used in hydraulics where variable volumetric flows (proportional directional control valve or proportional throttle) are needed together with load compensation (proportional flow control valve) or variable pressures (proportional pressure-relief valve). The equipment set provides information about proportional valves, how they function and how they are activated using proportional amplifiers and a setpoint value card. The set can be used to design, set and commission simply proportional control systems.

### Training content

Components:

- Design and function of different proportional valves
- Characteristic curves and characteristics of proportional valves
- Design and function of amplifiers and setpoint specification
- Getting to know the characteristics of the 1 and 2-channel amplifier
- Completely setting the 1-channel amplifier
- Setting the basic current, step current and maximum current
- Getting to know the characteristics of the 4/3-way proportional valve and the proportional pressure-relief valve
- Deriving the settings for the 2 channel amplifier
- Setting ramps
- Deriving the ramp settings from the function diagram

Measurements and calculations:

- Determining characteristic curves and characteristics of valves and equipment
- Measuring parameters such as pressure, volumetric flow and time
- Calculating the flow for proportional directional control valves
- Calculating speeds for double-acting cylinders with varying load
- Calculating the natural frequency of a cylinder drive
- Calculating times for acceleration and braking

Hydraulic circuits:

- Controlling pressure and speed
- Reading and creating hydraulic and electric circuit diagrams
- Creating a function diagram
- Designing and commissioning control systems, including fault finding

- Basic circuits for proportional hydraulics, such as pressure stage circuit, rapid traverse feed circuit, pump bypass, approaching positions, controlled acceleration and braking, logically connecting setpoint values, load-independent speeds
- Getting to know the pressure stage control system
- Braking a cylinder feed
- Reversing a hydraulic motor
- Setting process-dependent pressure stages
- Externally and logically interconnecting setpoint values
- Approaching a position with braking
- Creating a load-independent feed speed

**Complete equipment set TP 701 184465**

The most important components at a glance:

1	1x Relay, three-fold	162241
2	1x Proportional amplifier	162255
3	1x Setpoint value card	162256
4	1x Signal input, electrical	162242
5	2x Proximity sensor, inductive, M12	548643
6	1x 4/3-way proportional valve	544350
7	1x 4/2-way solenoid valve, spring return	544346
8	1x Proportional pressure relief valve	544351
9	1x Pressure filter	548609
10	1x Pressure balance (proportional flow control valve)	159351
11	1x Pressure relief valve	544335
12	1x Differential cylinder 16/10/200 with cover	572746
13	1x Hydraulic motor	152858
14	1x Flow control valve	152842
15	1x One-way flow control valve	152843
16	2x Pressure gauge	152841
17	2x T-distributor	152847
18	1x Weight, 9 kg, for cylinder	152972

Necessary accessories, also order:

5x	Hose line with quick release couplings, 600 mm	152960
2x	Hose line with quick release couplings, 1500 mm	159386
	Measuring case	177468
	Pressure relief unit	152971
	4 mm Safety laboratory cables → Page 247	
	Aluminium profile plate → Page 238	
	Hydraulic power pack → Pages 244 – 245	
	Protective cover for weight, 9 kg → Page 242	
	Tabletop power supply unit → Page 239	
	Power supply unit for mounting frame → Page 239	

Also order:

**Workbook**



Ten exercises provide an introduction to the equipment and circuits for proportional hydraulics. First of all, individual items of equipment are presented and their settings are tested. The graduated exercises then provide a complete solution.

The workbook contains:

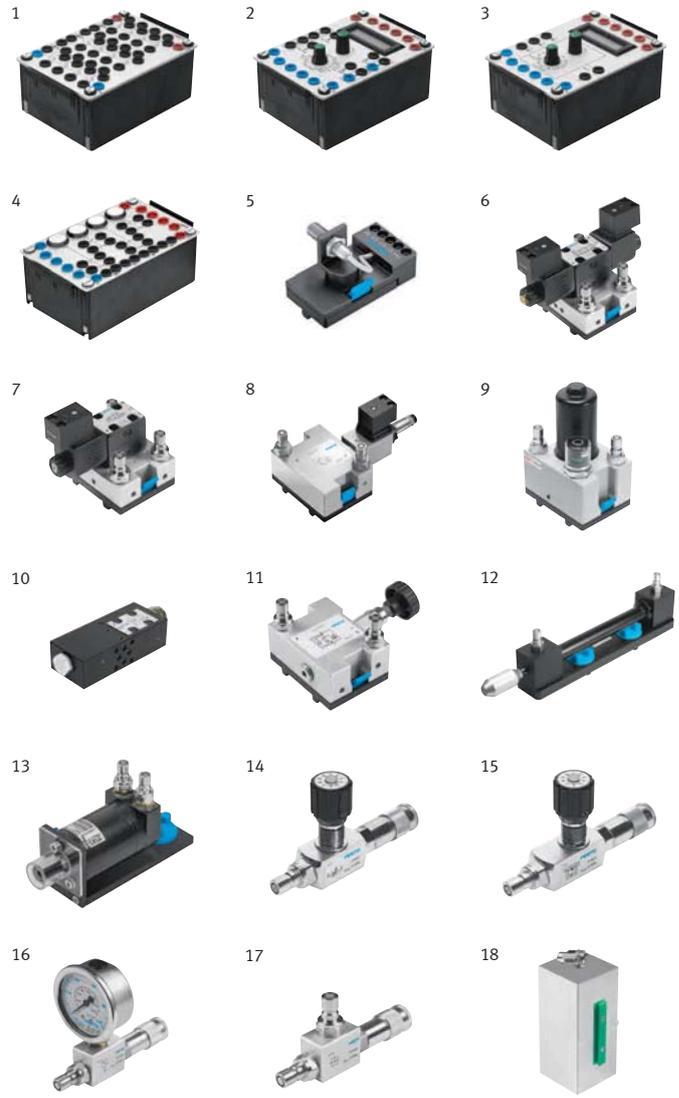
- Sample solutions
- Training notes
- Multimedia CD-ROM with graphics, photos of industrial applications, animations and FluidSIM® circuit diagrams
- Worksheets for students

Campus licence (→ Page 53):

de	94457
en	94472
es	94404
fr	94352

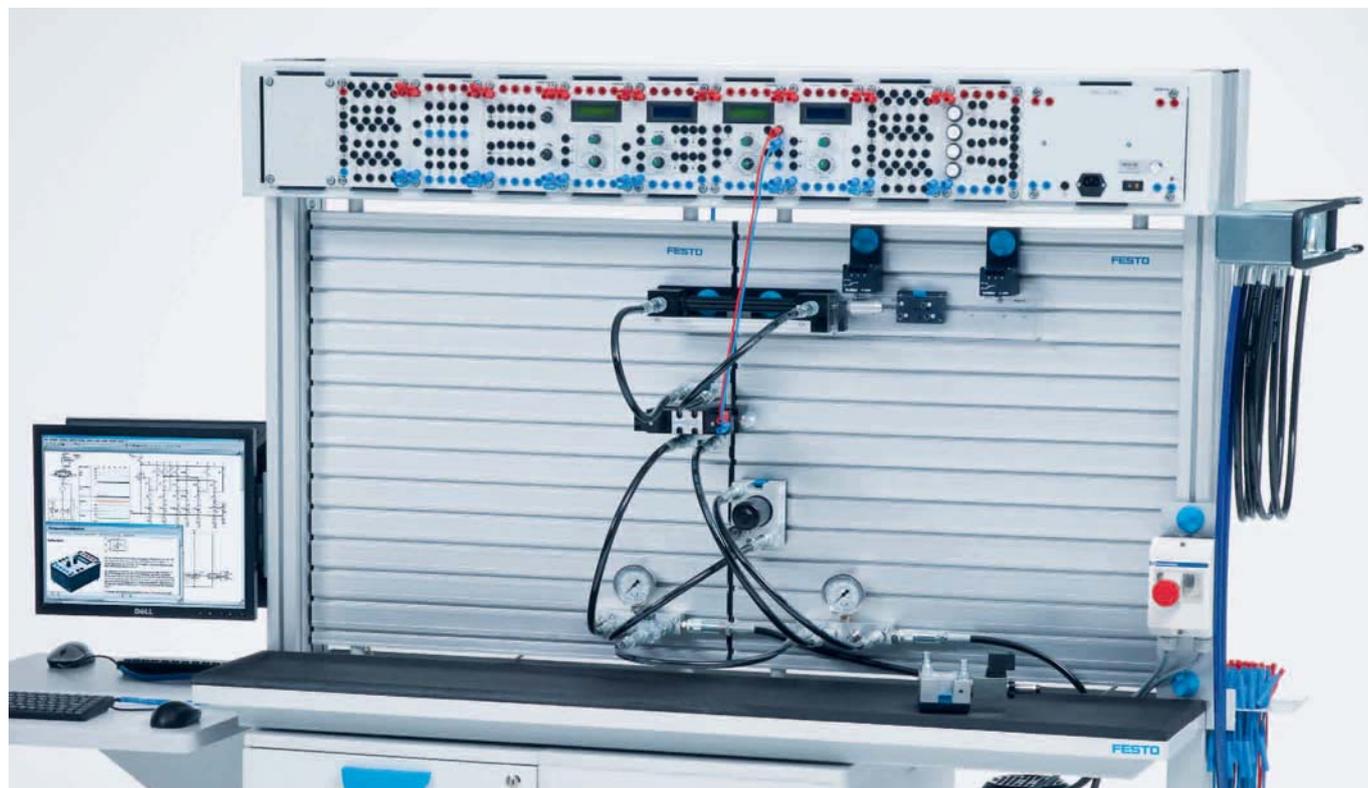
**Supplementary media**

- Designing and simulating with FluidSIM®
- Measuring and controlling with FluidLab®
- WBT Hydraulics
- WBT Electrohydraulics
- WBT Open- and closed-loop control
- Textbook: Proportional hydraulics, Basic level
- Hydraulics poster set



# Equipment set TP 702 – Advanced level

## Advanced proportional hydraulics training



### Proportional hydraulics, Advanced Level

The training package TP 702 builds directly on the material covered in package TP 701, Basic Level, and adds nine further, more in-depth and real-life case studies.

The package includes the following steps:

- Understanding the task using a positional sketch, diagram and problem description
- Designing the hydraulic circuit diagram
- Determining the necessary signal transmitters
- Compiling the sequence table
- Designing the electric signal control system
- Structuring and commissioning the proportional hydraulic control system
- Settings and evaluating the result

### Training content

Components:

- Determining characteristic curves and characteristics of different sensors
- Coordinating electrical and hydraulic equipment
- Creating characteristic curves for displacement, pressure and temperature sensors

Measurements and calculations:

- Measuring and processing parameters such as displacement, time, pressure and temperature
- Further signal processing of analogue signals

Hydraulic circuits:

- Controlling pressure, speed, acceleration, delay and position
- Reading and creating proportional hydraulic and electric circuit diagrams
- Reading motion diagrams
- Designing and commissioning proportional hydraulic control systems, including fault finding
- Adjusting and coordinating as per the specified procedure description
- Using basic circuits for proportional hydraulics such as: speed, rotational speed, stage, acceleration, braking and differential circuits, as well as positioning
- Implementing specific displacement-time and positioning programs
- Setting precise switch-off positions
- Implementing drive acceleration with a proportional pressure-relief valve
- Implementing oscillating movements for a cylinder with a proportional hydraulic control system
- Implementing the specified speed profile by means of an additional bypass circuit and slow retraction to the end positions
- Implementing a travel process with a 2/2-way proportional valve and a proportional pressure-relief valve

**Complete equipment set TP 702 184466**

The most important components at a glance:

1	1x Setpoint value card	162256
2	1x Comparator	162257
3	1x Time relay, two-fold	162243
4	1x Indicator unit and distributor, electrical	162244
5	3x Relay, three-fold	162241
6	1x Limit switch, electrical, left-actuated	183322
7	1x Limit switch, electrical, right-actuated	183345
8	1x Proximity sensor, capacitive, M12	548651
9	1x Proximity sensor, optical, M12	572744
10	1x Non-return valve, delockable	544339
11	1x T-distributor	152847
12	1x Non-return valve, 0.05 MPa opening pressure	548617
13	1x Displacement encoder for cylinder, 200 mm stroke	167090
14	1x Mounting kit for cylinders	544371

Necessary accessories, also order:

5x	Hose line with quick release couplings, 600 mm	152960
3x	Hose line with quick release couplings, 1000 mm	152970
2x	Hose line with quick release couplings, 1500 mm	159386
	Measuring case	177468
	Pressure relief unit	152971
	4 mm Safety laboratory cables → Page 247	
	Aluminium profile plate → Page 238	
	Hydraulic power pack → Pages 244 – 245	
	Protective cover for weight, 9 kg → Page 242	
	Power supply unit for mounting frame → Page 239	

Also order:

**Workbook**


Nine exercises illustrate the most important circuits and equipment in proportional hydraulics. To carry out the exercises, the equipment sets for proportional hydraulics TP 701 (Basic Level) and TP 702 (Advanced Level) are required.

The workbook contains:

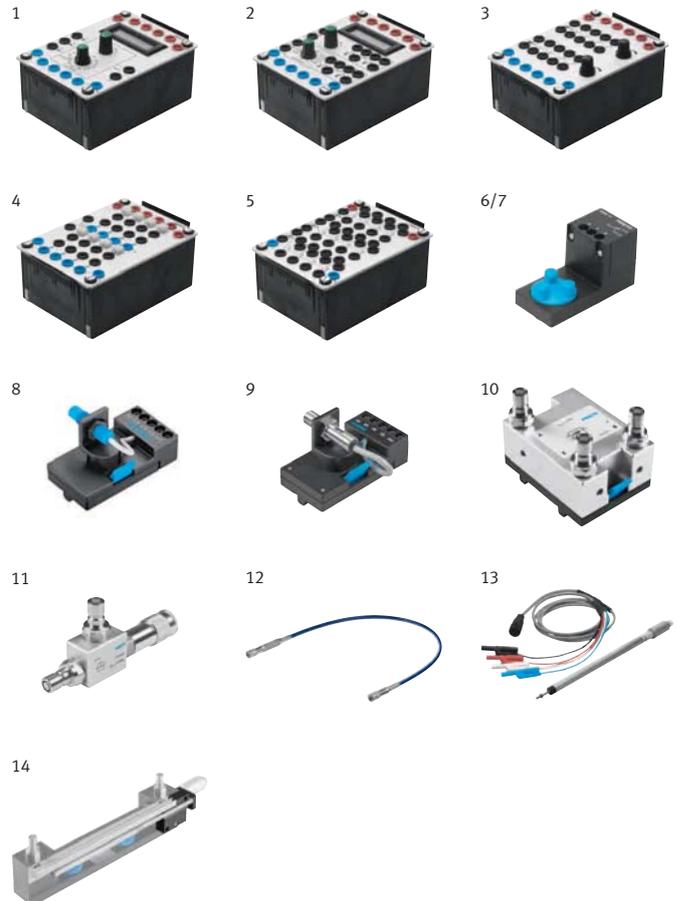
- Sample solutions
- Training notes
- Worksheets for students

Campus licence (→ Page 53):

de	94458
en	94473
es	94450

**Supplementary media**

- Designing and simulating with FluidSIM®
- Measuring and controlling with FluidLab®
- WBT Hydraulics
- WBT Electrohydraulics
- WBT Open- and closed-loop control
- Textbook Proportional hydraulics, Basic level
- Hydraulics poster set



# Equipment set TP 511

## Basic closed-loop hydraulics training



### Closed-loop hydraulics, Basic Level

Hydraulic closed-loop control circuits are normally operated with continuous valves. A control valve with integrated electronics, linear characteristic curve (volumetric flow to control piston position) and zero overlap makes commissioning easy and provides good results in the closed-loop control circuit.

### Training content

#### Position control circuits:

- Characteristic curve of a displacement sensor
- Flow rate characteristics of a continuous directional control valve
- Linear unit as a controlled system for position control
- Designing and commissioning a position control circuit
- Lag errors in the position control circuit
- Position control with a changed controlled system
- Commissioning a position control circuit with disturbances
- Characteristics and transition functions of a status controller
- Parameterising a status controller

#### Pressure control circuits:

- Characteristic curve of a pressure sensor
- Controlled system for pressure control
- Characteristics of a PID controller board

- Transition function of a P controller
- Control performance of a pressure control circuit with P controller
- Transition functions of I and PI controllers
- Transition functions of D, PD and PID controllers
- Empirical parameterisation of a PID controller
- Parameterising using the Ziegler-Nichols method
- Changed controlled system with disturbances

#### Controllers in hydraulics:

- Controlled systems with and without compensation
- Low-delay hydraulic controlled systems
- First, second and third order hydraulic controlled systems
- Classifying controlled systems according to their step response
- Operating point and controller amplification
- Discontinuous controllers
- Block diagrams for discontinuous and continuous controllers
- P, I, D, PI, PD and PID controllers

- Status controllers
- Selecting the controller structure
- Disturbance reaction and control factor
- Designing control circuits
- Hydraulic, mechanical and electrical controllers
- Analogue and digital controllers
- Selection criteria for controllers

#### Valves and measuring systems:

- Designation, circuit symbols and function of continuous directional control valves
- Stationary characteristics and dynamic behaviour of continuous directional control valves
- Function, design and mode of operation of a pressure regulating valve
- Pressure control with a directional control valve
- Mode of operation and interface of a measuring system

**Complete equipment set TP 511 in equipment tray**
**8028723**

The most important components at a glance:

1	1x PID controller	162254
2	1x Status controller	162253
3	2x Pressure sensor	525964
4	1x Pressure gauge	152841
5	1x Hydraulic motor	152858
6	1x Flow sensor	567191
7	1x Pressure filter	548609
8	1x Flow control valve	152842
9	1x Shut-off valve	152844
10	2x 4-way distributor with pressure gauge	159395
11	2x T-distributor	152847
12	1x 4/3-way regulating valve	567269
13	1x Linear drive	8028726
14	2x Weight, 5 kg, for linear drive	34065

Necessary accessories, also order:

4x	Hose line with quick release couplings, 600 mm	152960
3x	Hose line with quick release couplings, 1000 mm	152970
2x	Hose line with quick release couplings, 1500 mm	159386
2x	Hose line with quick release couplings, 3000 mm	158352
1x	Pressure relief unit	152971
1x	Function generator	152918
3x	Cable BNC – 4 mm	152919
1x	Cable BNC – BNC	158357
1x	T-connector BNC	159298
	4 mm Safety laboratory cables → Page 247	
	Digital multimeter → Page 250	
	Aluminium profile plate → Page 238	
	Digital storage oscilloscope → Page 252	
	Hydraulic power pack $q > 3.5$ l/min → Pages 244 – 245	
	Power supply unit for mounting frame → Page 239	

Also order:

**Workbook**


The 20 exercises in this book are used to introduce the fundamentals of analogue closed-loop hydraulics: pressure and position control with PID controllers and position control with status controllers. For extra task number 21, which deals with position control with disturbance variables and an active load, the cushion-

ing cylinders for linear drives (order no. 152295), three additional tubing lines with quick connection coupling and a shut-off valve (order no. 152844) are required. These are not included in the scope of delivery.

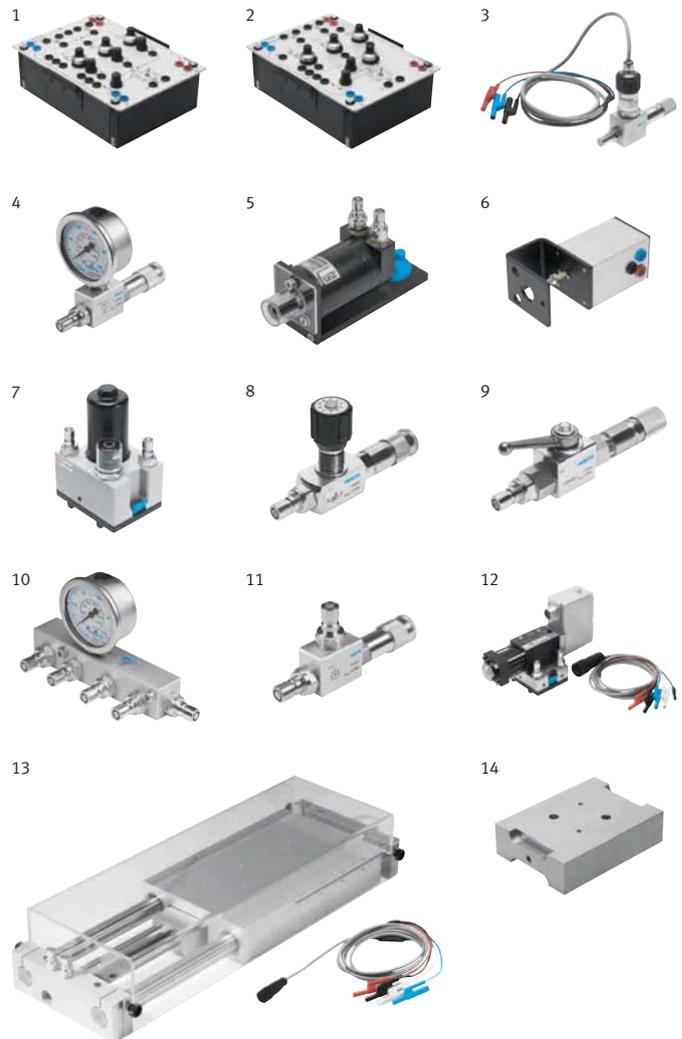
The workbook contains:  
 – Sample solutions, training notes  
 – Worksheets for students

Campus licence (→ Page 53):

de	94460
en	94469
es	94368
fr	94348

**Supplementary media**

- FluidSIM®
- FluidLab®
- WBT Hydraulics
- WBT Electrohydraulics
- WBT Open- and closed-loop control
- Textbook Proportional hydraulics, Basic level
- Hydraulics poster set



# BIBB hydraulics equipment sets

## Suitable for BIBB hydraulics course, lessons A – Z

### BIBB hydraulics equipment set – basic equipment set

Matches BIBB Hydraulics instruction course, exercises A-Z

#### Training content

The 21 exercises in the BIBB hydraulics course teach the fundamentals of hydraulic control engineering. Topics covered: hydraulic power pack, directional control valves and drives, shut-off and flow control valves, pressure regulators and pressure switches, hydraulic reservoirs, application switches, hoisting a load, Grätz switches, neutral circulation of the pump delivery, commissioning and maintenance.

#### Basic equipment set in the equipment tray **8025069**

The most important components at a glance:

1x Differential cylinder 16/10/200 with cover	572746
1x 3-way pressure reducing valve	544337
1x 2-way flow control valve	544338
1x Flow control valve	152842
1x One-way flow control valve	152843
4x T-distributor	152847
1x Diaphragm accumulator with shut-off block	152859
1x Weight, 9 kg, for cylinder	152972
1x Pressure switch, electronic	548612
1x Flow sensor	567191
2x Hydraulic motor	152858
1x Pressure relief valve, piloted	8025067
1x Pressure relief valve	544335
1x Non-return valve, delockable	544339
1x Shut-off valve	152844
2x Non-return valve, 0.05 MPa opening pressure	548617
2x Non-return valve, 0.6 MPa opening pressure	548618
2x Pressure gauge	152841
2x 4-way distributor with pressure gauge	159395

Necessary accessories, also order:

6x Hose line with quick release couplings, 600 mm	152960
4x Hose line with quick release couplings, 1000 mm	152970
4x Hose line with quick release couplings, 1500 mm	159386
Pressure relief unit	152971
4 mm Safety laboratory cables → Page 247	
Digital multimeter → Page 250	
Aluminium profile plate → Page 238	
Hydraulic power pack → Page 245	
Protective cover for weight, 9 kg → Page 242	
Tabletop power supply unit → Page 239	
Power supply unit for mounting frame → Page 239	

**Possible combinations** (only available when ordered as combination)

- Basic equipment set and electro-hydraulics equipment set extension (Order no. 8025069 and order no. 8025073)
- Basic equipment set and hand lever valve equipment set extension (Order no. 8025069 and order no. 8025072)
- Basic equipment set and hand lever valve equipment set extension and electro-hydraulics equipment set extension (Order no. 8025069 and order no. 8025072 and order no. 8025073)

### BIBB hydraulics equipment set – electro-hydraulics extension set

Required for the BIBB Hydraulics instruction course, exercises A-Z

When combined with the BIBB basic equipment set (order no. 8025069), the electro-hydraulics extension set covers all the devices required to complete the BIBB Hydraulics instruction course tasks A – Z.

#### Electro-hydraulics equipment set extension **8025073**

The most important components at a glance:

1x 4/2-way solenoid valve, spring return	544346
1x 4/3-way solenoid valve, closed mid-position	544347
1x 4/3-way solenoid valve, bypass mid-position (P → T)	544349
1x 4/3-way solenoid valve, relieving mid-position (AB → T)	544348
2x Relay, three-fold	162241
1x Signal input, electrical	162242
1x Time relay, two-fold	162243
1x Proximity sensor, inductive, M12	548643

### BIBB hydraulics equipment set – hand lever valve extension set

Optional for the BIBB Hydraulics instruction course, exercises without electro-hydraulics

When combined with the BIBB basic equipment set (order no. 8025069), the hand lever valve extension set covers all the devices required to complete the BIBB Hydraulics instruction course, except for the electro-hydraulics section of the course.

#### Hand lever valve extension set **8025072**

The most important components at a glance:

1x 4/2-way hand lever valve, spring return	544342
1x 4/3-way hand lever valve, closed mid-position, detenting	544343
1x 4/3-way hand lever valve, bypass mid-position (P → T), detenting	544345
1x 4/3-way hand lever valve, relieving mid-position (AB → T), detenting	544344

#### Recommended training media

- WBT Hydraulics
- Design and simulation program FluidSIM® Hydraulics

Also order:

#### BIBB Hydraulics instruction course

(on request)

# Equipment set TP 800 – Mobile hydraulics

## From basic principles to mobile machine

### Mobile hydraulics from Festo Didactic

Mobile hydraulics has a range of specific features compared to conventional industrial hydraulics. These are normally taught directly on a vehicle. But what if the components or the vehicle are not accessible or the entire system is too complex for teaching purposes?

#### Simplified

In contrast to a vehicle, with a learning system each hydraulic subsystem can be separately and individually constructed and examined. And measured values can be recorded almost everywhere for improved understanding.

#### Accessible

While in a vehicle there is usually little room and access is restricted to qualified personnel, the elements of a learning system are manageable, easy to identify and fault-tolerant.

#### Clean

Work on a vehicle usually means dealing with dirt and unpleasant weather. A learning system is clean and ergonomic.

With the mobile hydraulics equipment set, Festo Didactic closes the gap between the basic principles of hydraulics and hydraulic systems on a vehicle.

For an ideal introduction to mobile hydraulics, a hydraulic power unit is available, with variable displacement pump and load sensing controller and a constant displacement pump. This enables both basic and advanced levels to be taught and load simulations to be carried out with just one power unit.



#### Equipment sets:

##### Working hydraulics – Basic level

At the basic level, flow control with directional valves with different mid positions are compared in terms of their energy usage. This is done using a cylinder load simulator which, depending on the design, is capable of simulating a wide variety of different load situations.

In addition, the topics of holding and lowering the load and two 6/3 way valves for actuation of two drives are discussed using the series, parallel and tandem circuits.

As a transition to the Working hydraulics – Advanced level, a simple load sensing controller with constant pump is implemented.

##### Working hydraulics – Advanced level

Here, the focus is on load sensing systems with variable displacement pump. This includes the construction, operation and adjustment of a variable displacement pump with a load sensing controller and mobile or control block. The energy usage with flow control, open centre load sensing and closed centre load sensing with a variable displacement pump can then be compared.

Remote control and hydraulic pilot control of mobile blocks can also be discussed and developed. In addition, the effects of upstream and downstream pressure balances can be tested.

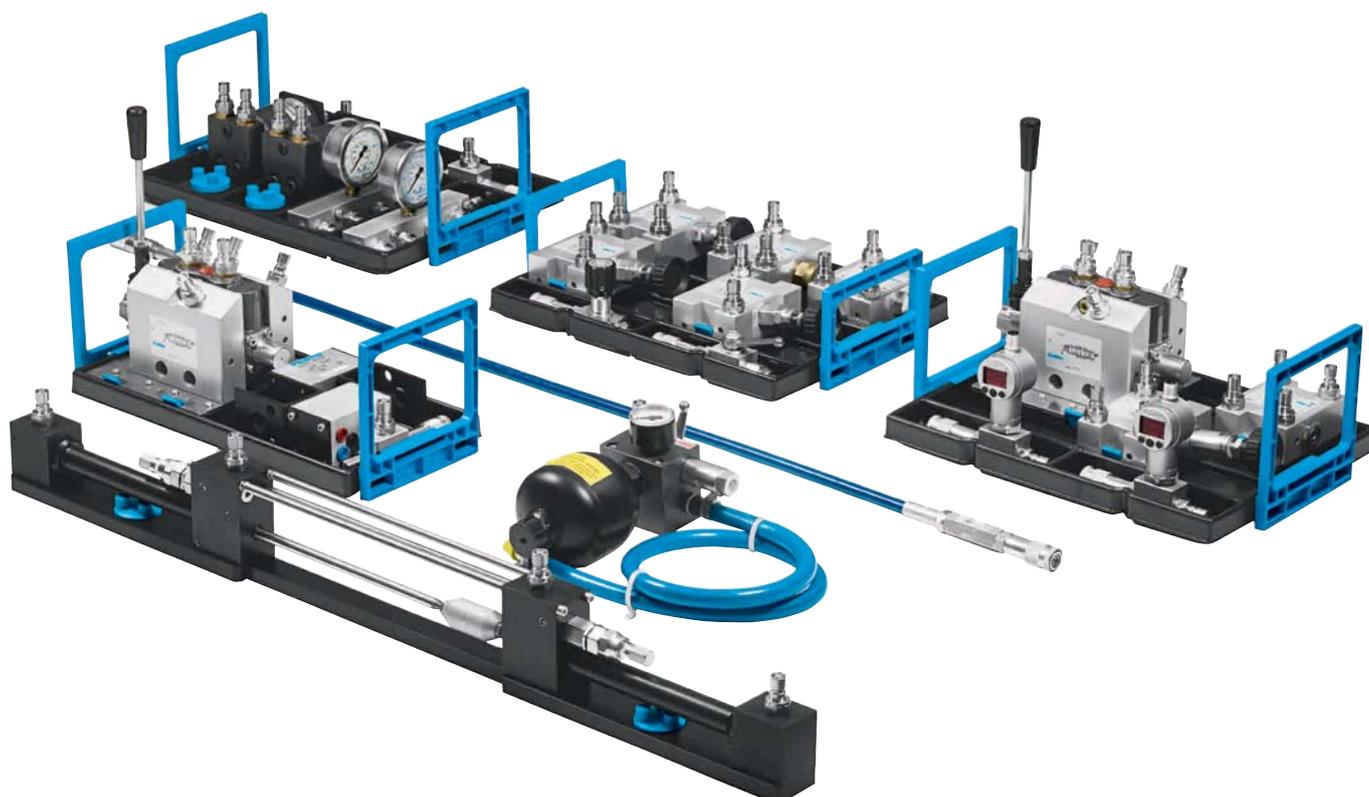
##### Hydrostatic steering system

The working hydraulics can also be extended with a steering system. This teaches the construction and functioning of a hydrostatic steering system, with typical shock and suction valves and double-rod cylinders.

The influence and effect of loads on the steering cylinder are investigated. Combinations of working hydraulics and a steering system based on different priorities can also easily be set up. This illustrates the effect of steering activity on the downstream working hydraulics.

# Equipment set TP 801 – Basic level

## Mobile hydraulics – Working hydraulics 1



### Mobile hydraulics from Festo Didactic

Mobile hydraulics has a range of specific features compared to conventional industrial hydraulics. Training content is therefore usually explained and demonstrated directly on the vehicle.

But what if the hydraulic components being explained or the vehicle are not accessible or the system is too complex for teaching purposes?

Festo Didactic's new training system closes the gap between the basic principles of hydraulics and the hydraulic systems on a vehicle.

### Complexity clarified

The new training packages for mobile hydraulics take components which often appear in vehicles as highly integrated functional modules and present them as separate, individual elements with unique symbols and clear terminal identification codes.

The teaching principle behind this is that of guiding students step by step from a simple component to a complex complete picture, with practical demonstrations. The universal compatibility of the single elements allows them to be used for other function units, making this equipment set highly flexible.

### Fully compatible

With uniform interfaces and a modular structure, it is possible to put together even quite complex entire systems. All mobile hydraulics elements are compatible with the current Festo Didactic equipment sets for hydraulics fundamentals, electrohydraulics, proportional and closed-loop hydraulics.

However, it is the double pump power unit with a pressure-limited constant displacement pump and variable displacement pump with load sensing control which forms the basis for the perfect training station and workstation. It also allows assembly of the load sensing system with TP 803.

Alternatively, it is possible to use a hydraulic power unit with a constant displacement pump and a volumetric flow rate of about 4 l/min for TP 801 and TP 802.

### TP 801 – training content

Many vehicles and applications make use of constant displacement pumps which continue to provide volumetric flow even when no hydraulic power is required. In TP 801, the energy usage of different systems – also when under load – is compared and assessed. Systems with multiple consuming devices are set up, connected in parallel, tandem and series, and examined in terms of characteristics such as priority, flow rate distribution, and pressure dependency.

The training also looks into the basics of holding the load with poppet valves and lowering the load with counter pressure and a counterbalancing valve.

**Complete equipment set TP 801 in equipment tray 574161**

The most important components at a glance:

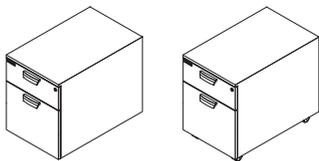
1	1x Counterbalance valve	572149
2	1x Pressure compensator for open centre load sensing	572123
3	1x 3-way pressure reducing valve	544337
4	2x Pressure relief valve	544335
5	1x Flow control valve	152842
6	1x Non-return valve, 0.6 MPa opening pressure	548618
7	1x Shuttle valve	572122
8	1x Double non-return valve, delockable	572151
9	1x Shut-off valve	152844
10	2x 6/3-way proportional hand lever valve	572141
11	1x Loading unit/cylinder load simulator	572145
12	1x Diaphragm accumulator with shut-off block	152859
13	2x Hydraulic motor	152858
14	2x 4-way distributor with pressure gauge	159395
15	3x T-distributor	152847
16	2x Pressure switch, electronic	548612
17	2x Flow sensor	567191

Necessary accessories, also order:

10x	Hose line with quick release couplings, 600 mm	152960
4x	Hose line with quick release couplings, 1000 mm	152970
2x	Hose line with quick release couplings, 1500 mm	159386
2x	Multimeter → Page 250	
	4 mm Safety laboratory cables → Page 247	
	Hydraulic power unit → Pages 244 – 245	
	Power supply unit for mounting frame → Page 239	

**The equipment tray**

The training package is supplied with an equipment tray. This equipment tray fits in the drawers of the workstations. A fixed drawer unit for mobile hydraulics with two drawers is recommended for particularly large components.



Fixed drawer unit for mobile hydraulics (2 drawers)

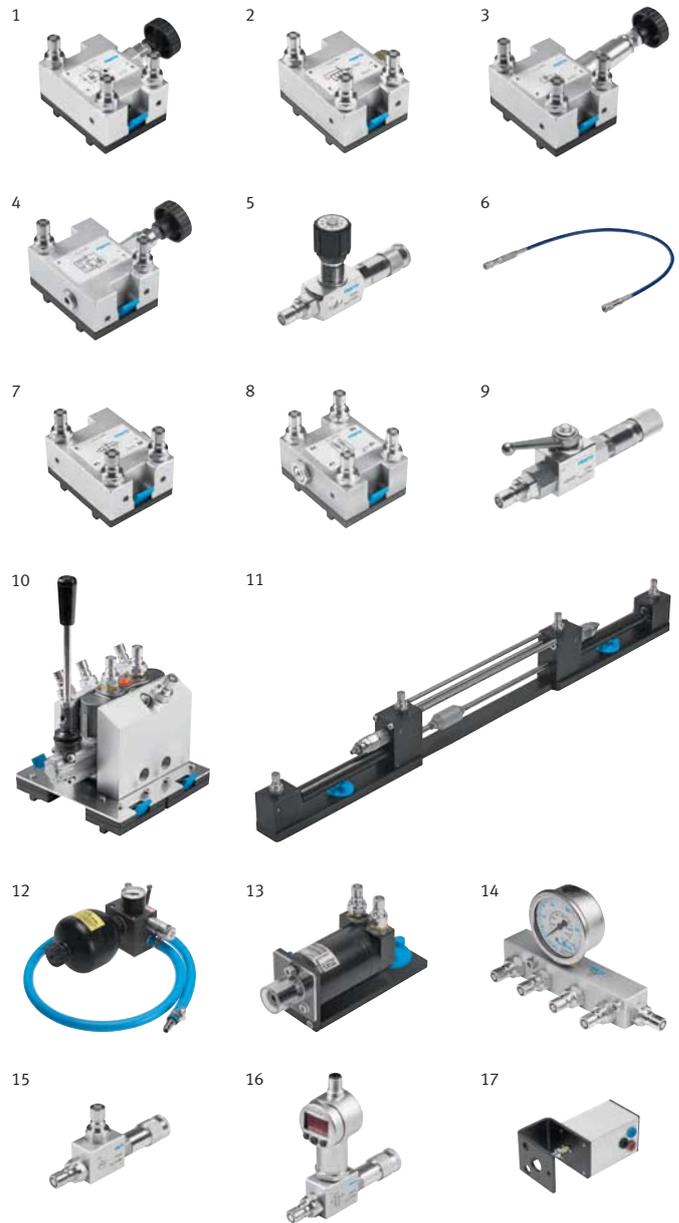
Order no. **574153**

Wheeled drawer unit for mobile hydraulics (2 drawers)

Order no. **574152**

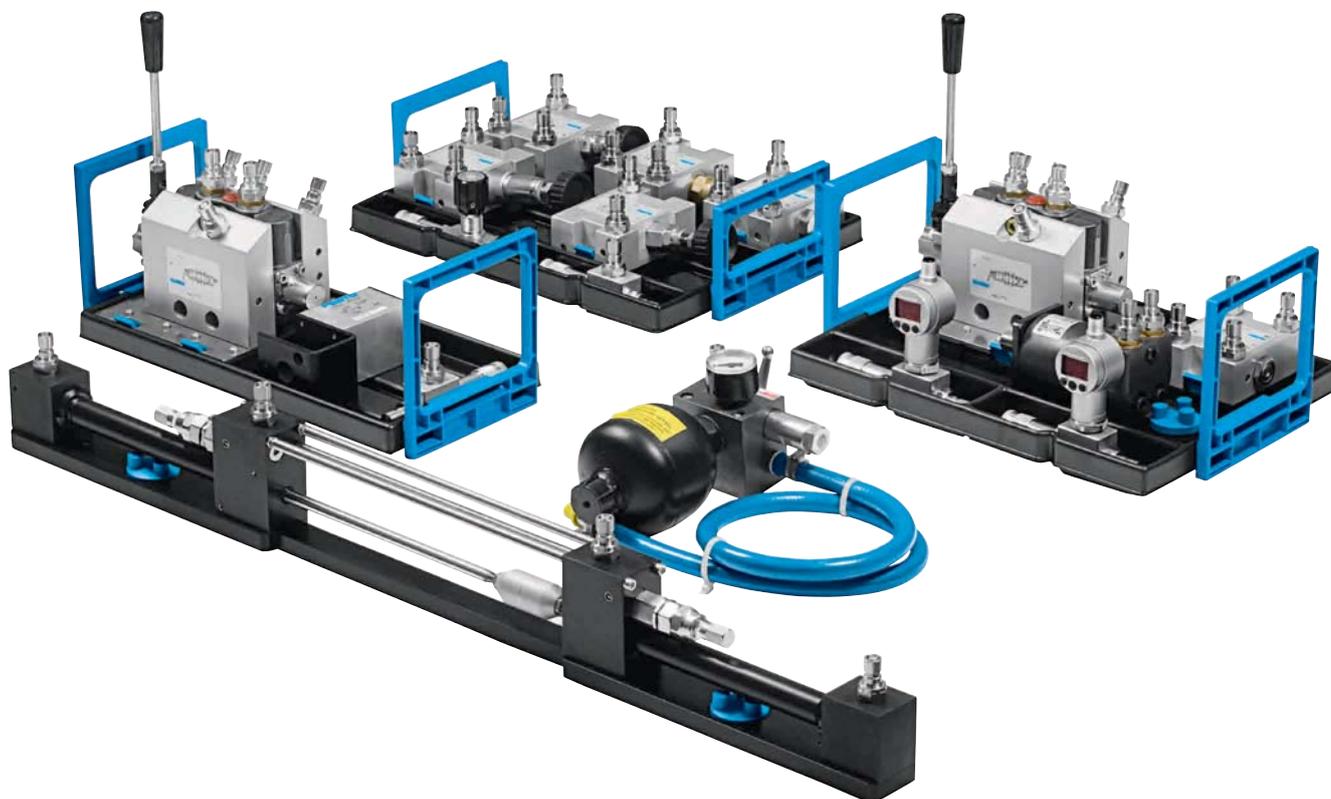
**The media on offer for TP 801**

- Workbook for mobile hydraulics TP 800
- Diagnostic system TP 810 with FluidLab®-M
- Designing and simulating with FluidSIM®
- WBT Hydraulics
- WBT Electrohydraulics
- Hydraulics poster set



# Supplementary equipment set

## Mobile hydraulics



### Supplementary equipment set from Hydraulics, Basic level TP 501 to Mobile hydraulics, Working hydraulics 1 TP 801

The supplementary equipment set extends TP 501 (order no. 573035) to form TP 801. The necessary accessories from TP 801 are required in order to carry out the exercises. Supplements are available on request for other/older equipment sets.

For training content, see Equipment set, Mobile hydraulics, Working hydraulics 1 TP 801.

Complete supplementary equipment set TP 501 – TP 801 in equipment tray **574160**

The most important components at a glance:

1x Counterbalance valve	572149
1x Pressure compensator for open centre load sensing	572123
1x 3-way pressure reducing valve	544337
1x Pressure relief valve	544335
1x Flow control valve	152842
1x Shuttle valve	572122
1x Double non-return valve, delockable	572151
2x 6/3-way proportional hand lever valve	572141
1x Diaphragm accumulator with shut-off block	152859
1x Loading unit/cylinder load simulator	572145
1x Hydraulic motor	152858
2x T-distributor	152847
2x Pressure switch, electronic	548612
1x Flow sensor	567191

# Mobile hydraulics TP 800

## Workbook



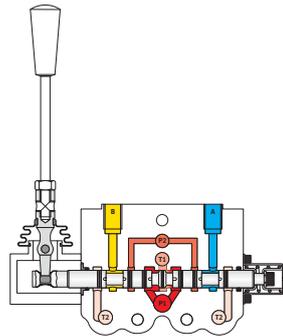
The workbook contains 21 project exercises designed for equipment sets TP 801, TP 802 and TP 803 together with the corresponding exercise sheets and sample solutions. It thus provides a comprehensive course companion conveying the essential knowledge and basic principles of the hydraulic systems of mobile machines.

The workbook contains:

- Basic information
- Exercise sections comprising project exercises and sample solutions for TP 801, TP 802 and TP 803
- Training notes
- Multimedia CD-ROM with supplementary media
- Worksheets for students

The basic level contains the following topics:

- Definition of terms and basic principles of hydraulics
- Closed hydraulic circuit
- Load-sensing systems and variable displacement pumps
- Flow divider
- Mobile control blocks
- 6/3-way proportional valves and valve configurations
- Pressure balances
- Holding and lowering loads
- Hydraulic pilot control (joystick)
- Priority valves
- Steering systems



### Exercise section TP 801 Working hydraulics 1

This training section, made up of 9 project exercises, is designed for the equipment set TP 801.

Each project exercise begins by presenting the training objectives which can be achieved. Next, the vehicle or application under discussion is presented. Parameters are provided to ensure a uniform starting point, and the project goal ensures a structured approach.

#### Energy usage

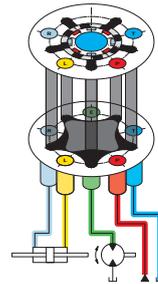
- Of flow control
- Of open centre load sensing
- Of a proportional valve (supply)
- Of a proportional valve (supply and discharge) with and without open centre load sensing
- Of a proportional valve with pump bypass with and without loaded cylinder

#### Holding load, lowering load

- Holding load (piloted non-return valves)
- Lowering load (counter pressure)
- Lowering load (counterbalancing valve)

#### Circuits with multiple loads

- Features of parallel connection
- Features of tandem connection
- Features of series connection



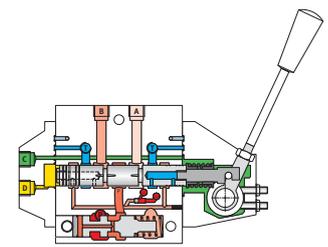
### Exercise section TP 802 Hydrostatic steering system

This training section, made up of 5 project exercises, is designed for the equipment set TP 802.

During all project exercises, trainees set up a circuit as per the instructions and the relevant circuit diagram, and carry out measurements and calculations. Each project exercise ends with a series of questions are asked to test trainees' understanding. The measurements, calculations and answers can then be compared with the sample solutions and discussed.

#### Basic principles of hydrostatic steering

- Structure of a steering system with through-rod cylinders
- Structure of a steering system with two differential cylinders
- Displacement of the steering valve
- Emergency steering characteristics of the steering valve
- Loads and overloads in the steering system
- Torque dependency of the steering valve
- Priorities of the steering system and secondary loads



### Exercise section TP 803 Working hydraulics 2

This training section, made up of 7 project exercises, is designed for the equipment set TP 803.

The content builds on the training content of TP 801, Working hydraulics 1 and expands it to include the complex topic of systems with a variable displacement pump with load sensing control. However, the complexity is kept to a manageable level because the project exercises are progressive, each building on the one before.

#### Load-sensing systems

- Design and function of a control block
- Control block with closed centre load sensing
- Control block with two loads
- Flow rate limitation on the control block
- Pilot control of a control block
- Dependencies of load and flow
- Functioning of an upstream pressure balance
- Pressure compensation for load sensing
- Characteristics of upstream pressure balances when there is more than one load
- Characteristics of downstream pressure balances when there is more than one load

L. Unan, U. Schedel, C. Löffler

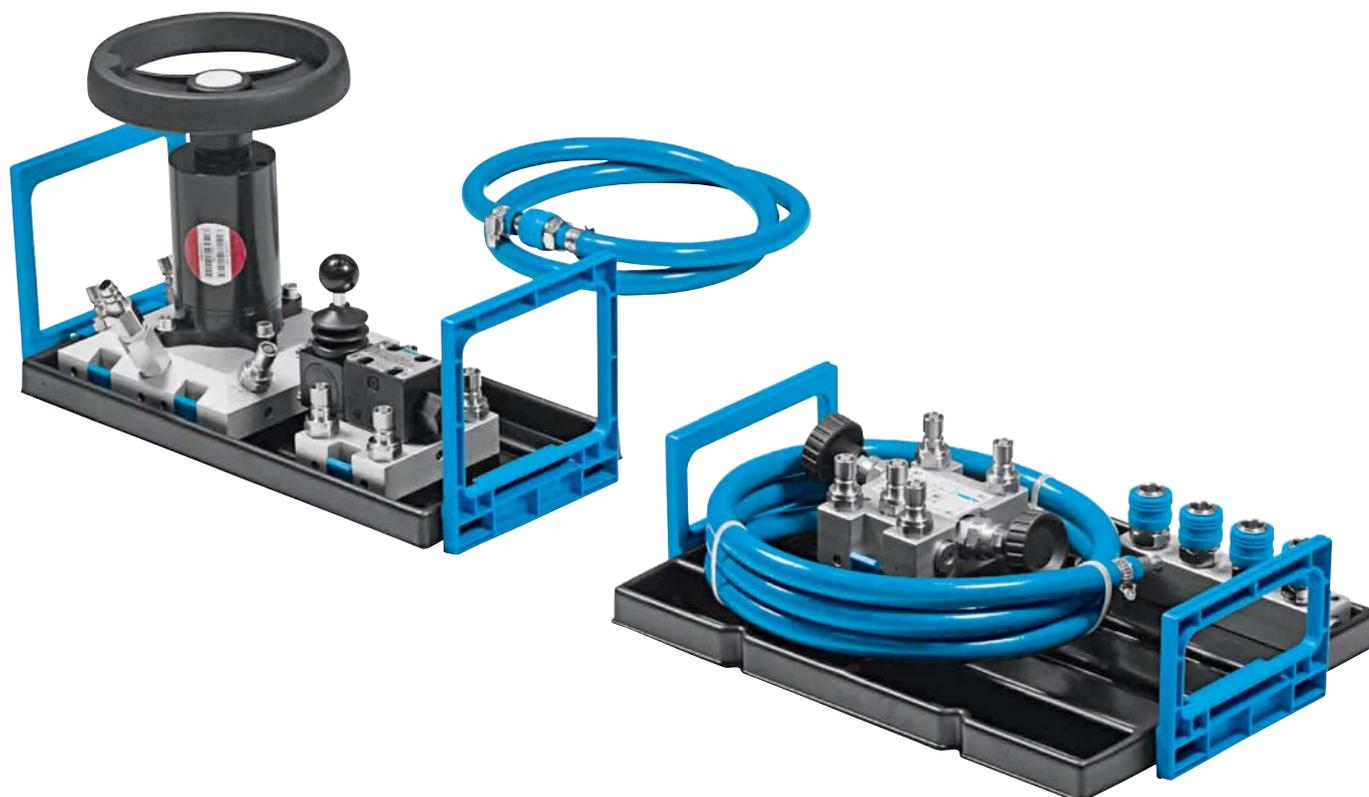
Edition 2013, 540 pages, colour, in folder.

Campus licence (→ Page 53):

de	574165
en	574166

# Equipment set TP 802 – Advanced level

## Mobile hydraulics – Hydrostatic steering system



### Hydrostatic steering system

Hydrostatic steering is an essential subsystem in many mobile machines and is especially well-suited to managing high steering forces.

The number and design of the components are specifically adapted to the projects in the workbook. This ensures a maximum return on the training with minimum effort.

### For multiple use

As with all Festo Didactic training packages, so too for mobile hydraulics: all components are designed to be used as parts of a single, compatible system. This means that many parts at basic level can also be used for experiments at advanced levels. Long-term maintenance of the interfaces is also an important part of the design, whether mechanical with Quick-Fix®, hydraulic with low-leakage couplings, or electrical with safety plug technology.

Components and accessories from the equipment set TP 801 are required to carry out the projects.

### Safety first!

Safety in the use of our training system is top priority. Many mobile hydraulics elements are not designed to be pressure resistant. This is why our oil return ports use an open coupling system. Students should nonetheless be made fully aware of safety matters. Making sure connections are correct will minimise impact on resources and the environment.

### TP 802 – training content

TP 802 promotes the practical testing and technical measurement of the structure and method of operation of a hydrostatic steering system, comprising a steering valve, anti-shock and anti-cavitation valves, steering cylinder(s), constant-displacement pump and (if needed) secondary loads.

The basics include the structure of different steering systems with through-rod and differential cylinders, and determining the displacement and the torque dependencies of the steering unit. In addition, emergency steering characteristics are explored and tested. An overload is applied to the system, its behaviour is analysed and anti-shock valves are set accordingly. The steering system's priority over a secondary load also forms part of this training package.

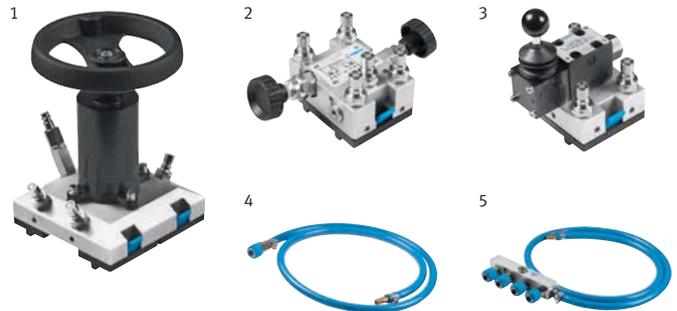
**Complete equipment set TP 802 in equipment tray 574162**

The most important components at a glance:

1	1x Steering unit (Orbitrol)	572146
2	1x Shock and anti-cavitation valve	572148
3	1x 4/3-way hand lever valve, relieving mid-position (AB → T), detenting	544344
4	1x Tubing line for unpressurised return	573024
5	1x 4-way return header, unpressurised	573026

Necessary accessories, also order:

9x	Hose line with quick release couplings, 600 mm	152960
4x	Hose line with quick release couplings, 1000 mm	152970
3x	Hose line with quick release couplings, 1500 mm	159386
2x	Multimeter → Page 250	
	4 mm Safety laboratory cables → Page 247	
	Hydraulic power unit → Pages 244 – 245	
	Power supply unit for mounting frame → Page 239	



**The media on offer for TP 802**

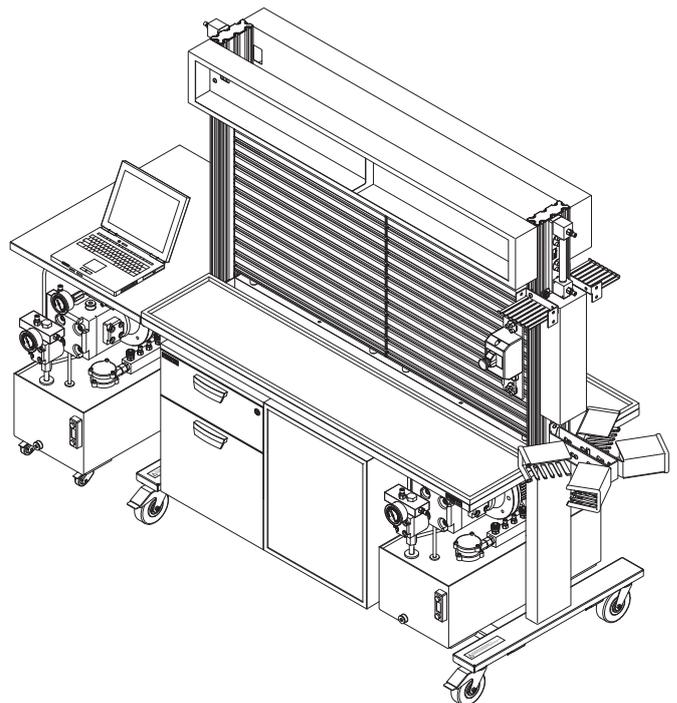
- Workbook for mobile hydraulics TP 800
- Diagnostic system TP 810 with FluidLab®-M
- Designing and simulating with FluidSIM®
- WBT Hydraulics
- WBT Electrohydraulics
- Hydraulics poster set

**The workstation system**

Learnline has a modular design and offers an almost unlimited range of configuration possibilities for the Learnline workstation, such as the table extension for PC-assisted measurement with TP 810 and FluidLab®.

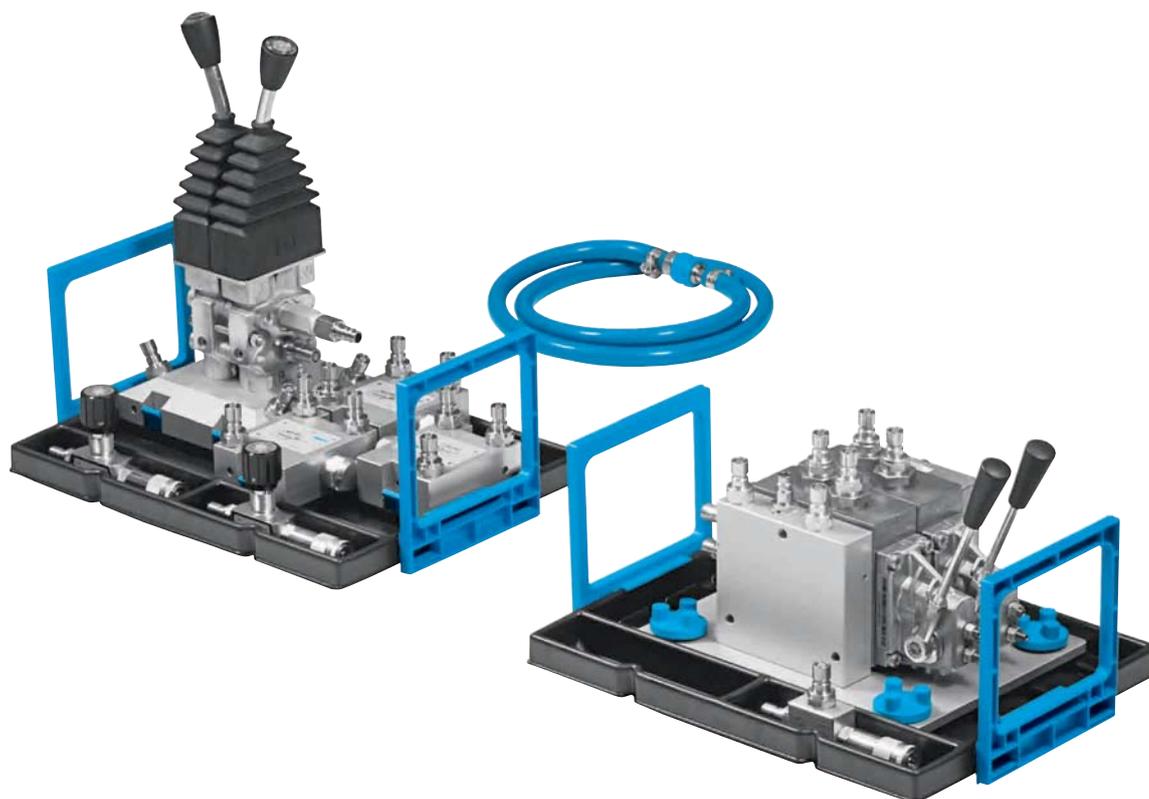
Learnline has a profile surface area of 1400 x 700 mm per side – lots of room for large components and complex circuits.

Quality isn't compromised as its construction and functionality are the very best. The torsionally rigid design and the high-quality coating on the work surface and frame guarantee a long service life despite high loads. Learnline can handle the hard daily lesson routine, as well as a vibrational load during the hydraulic position control.



# Equipment set TP 803 – Advanced level

## Mobile hydraulics – Working hydraulics 2



### Working hydraulics 2

The challenge for the efficient operation of machines is how to handle frequently changing loads and fluctuating speeds during the operation cycle.

Constant displacement pump systems generally have a very poor degree of efficiency in such cases, as they are always designed for the highest, most likely pressure and flow rate.

Load-sensing systems are different. Both the pressure and the flow rate are adapted to the actual needs. This requires a variable displacement pump with a load-sensing (LS) controller, as well as valves with the right type of control paths for load feedback to the pump controller.

### System behaviour under load

In practical applications, the challenge is to handle continuously changing large loads reliably and efficiently. To reflect this challenge properly in the training system, we have developed a cylinder load simulator which allows an extremely wide range of load types even with the TP 801 set.

An active or passive hydraulic counteracting force is applied to a combination of two differential or through-rod cylinders.

By doing away with large working loads and integrating an overload safeguard, the cylinder load simulator is not just highly flexible, but also safe to use and extremely manageable.

### TP 803 – Working hydraulics advanced level training content

The advanced level focuses on the load-sensing system with variable displacement pump, control block, pilot control and up to two loads.

Components and accessories from the equipment sets TP 801 and TP 802 are required to carry out the projects.

### The content:

- Design, mode of operation and setting of a variable displacement pump with load sensing controller and control block.
- Comparing and assessing the energy usage of flow control, open centre load sensing and closed centre load sensing with a variable displacement pump.
- Remote control and hydraulic pilot control of control blocks.
- Characteristics of load sensing systems with upstream and downstream pressure balances (flow distribution independent of load pressures).

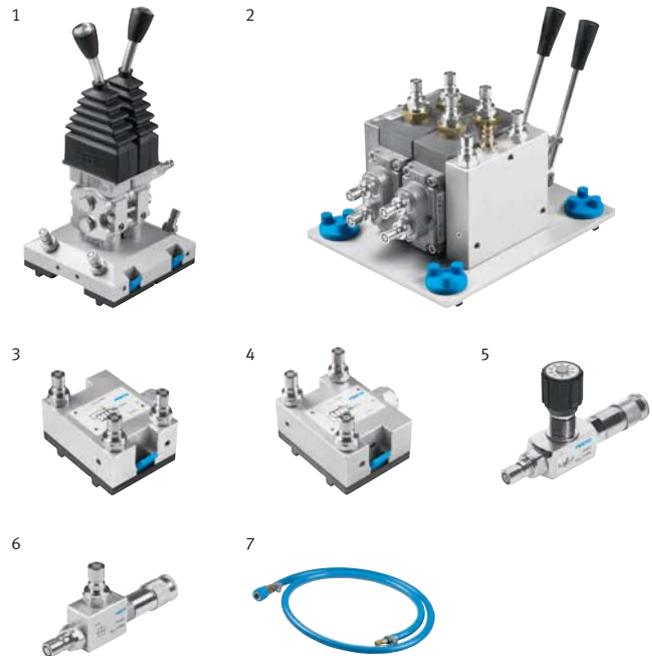
Complete equipment set TP 803 in equipment tray **574163**

The most important components at a glance:

1	1x Pilot valves (joystick), 2x2-channel	572147
2	1x Mobile valve block, Load sensing	572144
3	1x Pressure compensator, upstream (pre)	573023
4	2x Pressure compensator, downstream (post)	572741
5	2x Flow control valve	152842
6	1x T-distributor	152847
7	1x Tubing line for unpressurised return	573024

Necessary accessories, also order:

10x	Hose line with quick release couplings, 600 mm	152960
6x	Hose line with quick release couplings, 1000 mm	152970
3x	Hose line with quick release couplings, 1500 mm	159386
2x	Multimeter → Page 250	
	4 mm Safety laboratory cables → Page 247	
	Hydraulic power unit → Pages 244 – 245	
	Power supply unit for mounting frame → Page 239	



### The hydraulic power unit

The power unit used for the mobile hydraulics training packages is a variable and constant displacement pump combination. The constant displacement pump is ideal both for the basic principles of hydraulics and electrohydraulics and for the mobile hydraulics sets TP 801 and TP 802. With TP 803, the focus shifts to the variable displacement pump with LS controller, with the function of the constant-displacement pump now being applied to active hydraulic loads on the cylinder load simulator.



### The media on offer for TP 803

- Workbook for mobile hydraulics TP 800
- Diagnostic system TP 810 with FluidLab®-M
- Designing and simulating with FluidSIM®
- WBT Hydraulics
- WBT Electrohydraulics
- Hydraulics poster set

# Equipment set TP 810 – Advanced level

## Diagnostic system FluidLab®-M: Measurement – Visualisation – Analysis



### A greater understanding of diagnostic systems

System diagnostics, condition monitoring and energy efficiency are becoming more important all the time.

A fluid power system can only be optimally set if measurements are taken at the correct points. The correct conclusions must then be drawn from the measurement data. However, with dynamic system conditions, measuring techniques such as the use of a pressure gauge are pushed to their limits. That is why permanent measured data acquisition with visualisation of measurement curves is necessary. Servicing and maintenance personnel then have access to crucial information for the tasks at hand and settings required. FluidLab®-M is the universal measuring tool for all pneumatic and hydraulic training packages.

### The new FluidLab-M®

Do you want the measuring system for your fluid power circuits, processes or systems to be simple but high quality? To start with, any number of sensors with voltage output and connected to a PC via EasyPort, can be adapted to the measurement software in a few simple steps. Your sensor settings, designations and ranges of values are stored and immediately ready to use next time. FluidLab-M® can record up to four analogue and digital inputs simultaneously.

### Reproducible measurement processes

Simply start the measurement and record digital and analogue input and output signals. During the measurement, you can set and reset the digital outputs manually and control the analogue outputs. A reproducible, controlled measurement process is important if you want to be able to compare series of measurements. This is a particular strong point of FluidLab®-M. The measurement process can be programmed and saved directly in a text editor using a simple programming code. Delay times, jump or repeat commands, and periodic analogue output signals can all be programmed, for example.

### Visualisation and analysis

Two display modes are available for measured data data acquisition. One is with up to two Y-axes over time (X-axis). For example, changes in pressure and flow rate over the course of a cycle can be recorded. The other is an XY graph to record e.g. a flow control or pump characteristic, in other words pressure over flow rate. The measured values can be saved and superimposed with other records within the software, or compared and analysed. There are two measuring cursor and zoom and detail functions available for the purpose of analysis. Alternatively, a spreadsheet program such as Microsoft Excel can be used to open and work with the measured values.

**Complete equipment set TP 810 in equipment tray 574164**

The most important components at a glance:

1	1x EasyPort USB	548687
2	1x Analogue cable, parallel, 2 m	529141
3	1x I/O data cable with SysLink connectors (IEEE 488) at both ends, 2.5 m	34031
4	1x Universal connection unit, digital (SysLink)	162231
5	1x Quick-Fix screw adapter	549806
6	1x Connection unit, analogue	567232
7	1x FluidLab-M Single license, de/en	573029



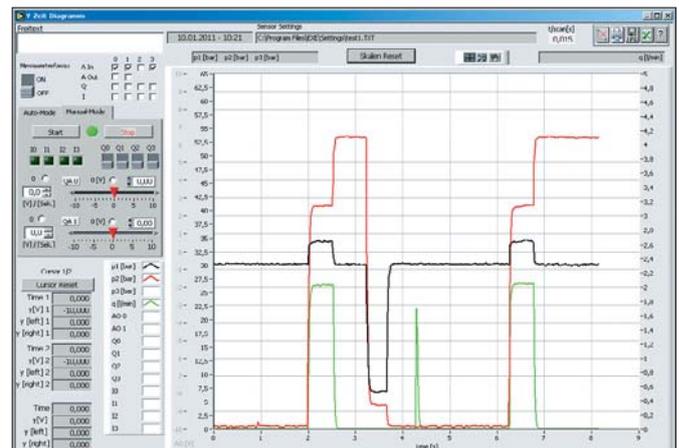
**System requirements**

- PC with Windows XP/7/8
- Pentium® III or equivalently
- 2 GB RAM
- CD-ROM disk drive
- USB 2.0 or serial interface
- 1280 x 1024 pixels
- NI LabView 2012 Runtime (included in scope of delivery)

Measurements can be carried out with any sensor with voltage output and 4 mm safety plug. Sensors are not included in scope of delivery.

**The media on offer for TP 810**

- Workbook for mobile hydraulics TP 800
- Designing and simulating with FluidSIM®
- WBT Hydraulics
- WBT Electrohydraulics
- Hydraulics poster set



## Electrical engineering/Electronics training packages





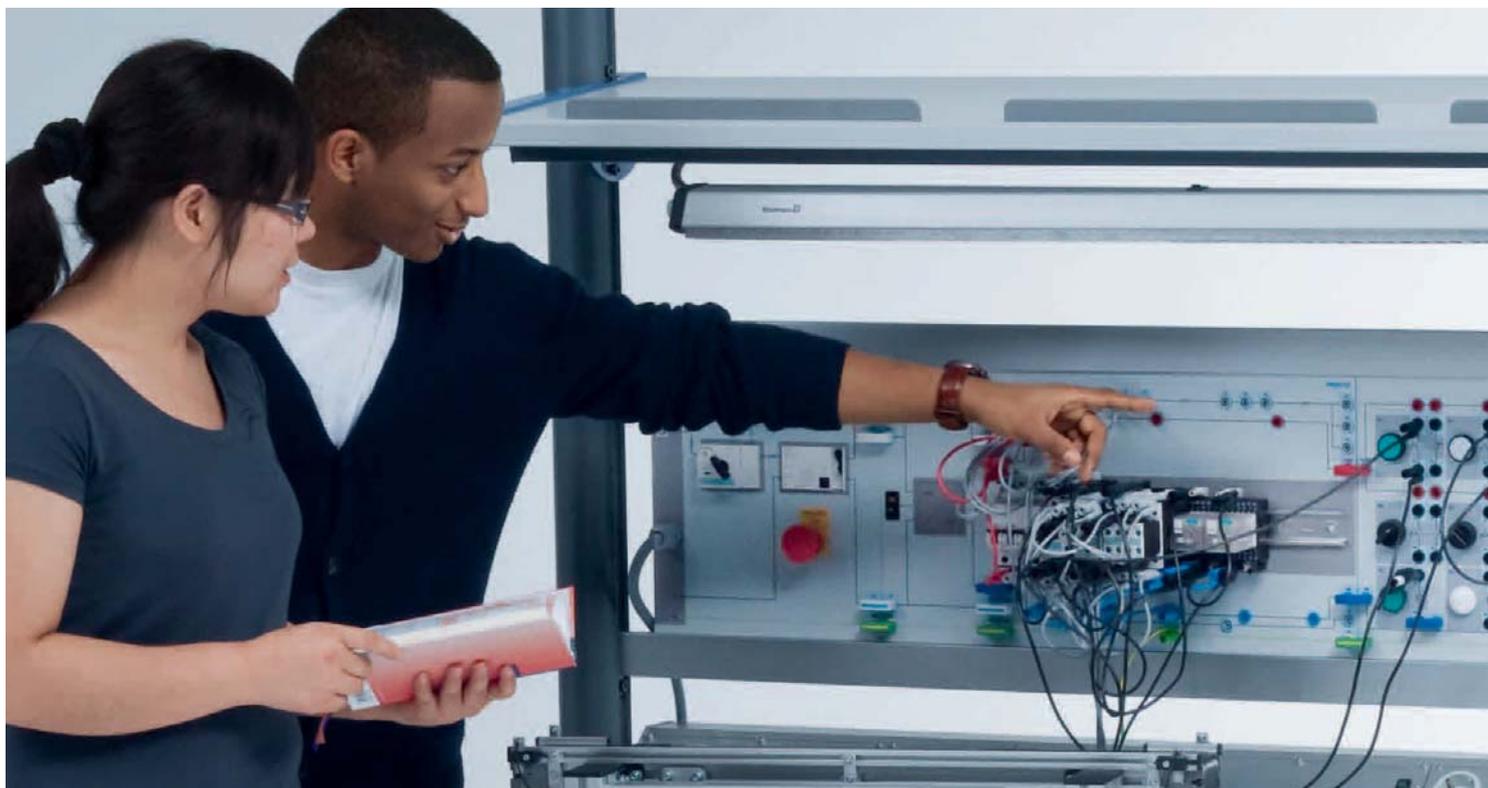
System description .....166

**Equipment sets**

Fundamentals of electrical engineering.....168  
Building automation systems.....176  
Control technology.....186  
Electric drive technology .....188

# Electrical engineering/Electronics training packages

## 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 CD-ROM 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 WBTs 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 WBTs are particularly well suited for teaching the basic principles and thus provide the optimum supplement to practical experiments.



**Mobile solution**

Anyone who wants to design varied teaching and personal learning concepts requires flexible and modular training systems. That is why most of the equipment sets from Festo Didactic are compatible with the practical and mobile Systainers. This makes storage and transportation easier and supports flexible working.



product design award

2011



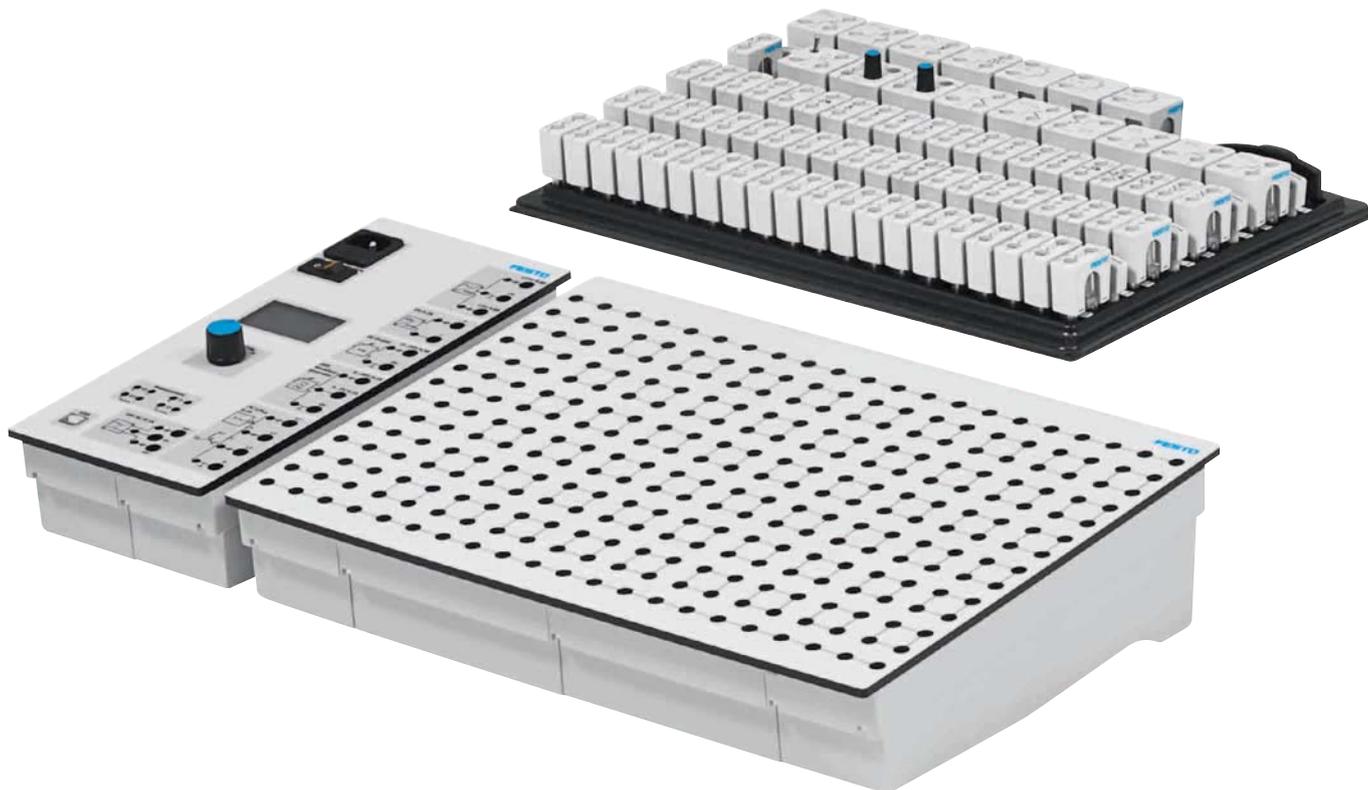
**Winner**

of the iF product design award 2011 and the Focus design award in Silver 2011:

**Equipment set TP 1011  
Basic principles of electrical engineering/electronics**

# Equipment set TP 1011

## Fundamentals of electrical engineering/electronics



### The basis of everything – Electrical engineering and electronics

The universal patch panel of this training package uses the proven 19 mm grid. The universal patch panel and basic power supply unit, which provides a function generator among other things, form the basis on which the digital and control technology component sets can be used.

With the component set, all basic tests of DC, AC and semiconductor technology can be performed and basic electronic circuits can be examined. The storage panel, with its clearly labelled slots, provides order and structure.

The equipment set variant TP 1011 M additionally contains a measuring module integrated in the power supply unit and the necessary measuring leads, adapters, and the PSURemote software.

### Training content

#### – Direct current

Voltage, current, resistance, conductance, Ohm's law, using measuring devices, energy and capacity, series and parallel connections, voltage dividers, non-linear resistors, bridge circuit, voltage source

#### – Alternating current

Electric field, induction, capacitor and coil in DC and AC circuit, series and parallel circuits, active resistance, reactance and impedance, phase shift of current and voltage

#### – Semiconductors

Semiconductor diode, Zener diode, LED, bipolar transistors, unipolar transistors, diac, triac, thyristor

#### – Basic electronics circuits

Transistors and basic circuits, multi-level amplifiers, power amplification, differential and direct current amplifier, impulse and saw tooth generators, sine wave generators, power supply unit circuits



### On the safe side!

The system is completely equipped with safety plugs and sockets based on state-of-the-art technology.

This applies to all electrical connections – whether on the components or devices. The equipment set is therefore ideal for use in any laboratory, even if there are high voltages present. Safety first!

### Easy to connect!

Safety plugs at the bottom, safety sockets at the top – each component has double the connections.

As a result, measurements can be taken at any time without having to modify the circuit, and parallel connections are easy to establish.

**Complete equipment set TP 1011 571780**

The most important components at a glance:

1	1x EduTrainer basic power supply unit without integr. measuring module	576624
2	1x Universal patch panel EduTrainer	567322
3	1x Component set for electrical engineering/electronics	567306
4	1x Safety jumper plugs, 28 pieces, grey-black	571809

**Complete equipment set TP 1011 M 8029635**

The most important components at a glance:

1	1x EduTrainer basic power supply unit with integrated measuring module	567321
2	1x Universal patch panel EduTrainer	567322
3	1x Component set for electrical engineering/electronics	567306
4	1x Safety jumper plugs, 28 pieces, grey-black	571809
	4x 2 mm Safety laboratory cables, 500 mm, red	576295
	4x 2 mm Safety laboratory cables, 500 mm, blue	576296
	8x 4 mm – 2 mm safety measuring adapter	8023960
	1x PSURemote Software, de/en → Page 171	574179

Necessary accessories, also order:

IEC power cable → Page 239
4 mm Safety laboratory cables → Page 247
2x Digital multimeter → Page 250
Digital storage oscilloscope → Page 252

Possibilities of expansion:

Set of components for digital technology → Page 173
Set of components for control technology → Page 175
Operational amplifier 576621

Also order:

**Workbooks**

The exercises contain concrete, realistic projects with problem descriptions, parameters and project tasks.

In addition to the basic principles of electrical engineering, the workbooks also thoroughly explain the function of the components, their characteristic values and the basic circuits typical for the components.

- Sample solutions
- Educational instructions
- Multimedia CD-ROM with graphics
- Worksheets for learners

The worksheets support the learner in the information and planning phase as well as with execution, monitoring and documentation.

**Fundamentals of direct current technology**

Campus licence (→ Page 53):

de	567207
en	567209
es	567211
fr	567213

**Fundamentals of alternating current technology**

Campus licence (→ Page 53):

de	567215
en	567217
es	567219
fr	567221

**Fundamentals of semiconductors**

Campus licence (→ Page 53):

de	567281
en	567283
es	567285
fr	567287

**Basic electronics circuits**

Campus licence (→ Page 53):

de	567289
en	567291
es	567293
fr	567295



product design award

2011



**Equipment set TP 1011**

Winner of the international design prizes

## Equipment set TP 1010

### Basic principles of electrical engineering for metalworking occupations



#### Basic principles of electrical engineering for metalworking occupations

Can you limit your training to DC and AC technology now and in the future? Then this equipment set, with the small Combiboard Fundamentals EduTrainer® and a reduced range of components, is an economical alternative to TP 1011.

A basic knowledge of circuits is becoming more important even in mechanical professions. It is important for understanding many functions and processes in complex systems.

The examples used by the training package Basic principles of electrical engineering for metalworking occupations to teach the basic principles are taken from this field. The learning objectives include the electrical variables and their relationships with each other. With the project-based exercises, the content can be clearly taught through theory and practical tests. Measurements illustrate relationships, and promote understanding and in-depth learning.

The component set contains all of the components for carrying out basic tests for DC and AC technology. The clearly labelled slots of the storage panel provide order and structure.

#### Training content

- **Direct current technology**  
Voltage, current, resistance, conductance, Ohm's law, using measuring devices, energy and capacity, series and parallel connections, voltage dividers, non-linear resistors, bridge circuit, voltage source
- **Alternating current technology**  
Electric field, induction, capacitor and coil in DC and AC circuit, series and parallel connection, active resistance, reactance and impedance, phase shift of current and voltage



#### On the safe side!

The system is completely equipped with safety plugs and sockets based on state-of-the-art technology.

This applies for all electrical connections - whether on the components or on the Combiboard. The equipment set is therefore ideal for use in any laboratory, even if there are high voltages present. Safety first!

Complete equipment set TP 1010 **8023958**

The most important components at a glance:

1	1x Combiboard Fundamentals EduTrainer	571810
2	1x Set of components for electrical engineering	8005374
3	1x Safety jumper plugs, 28 pieces, grey-black	571809

Necessary accessories, also order:

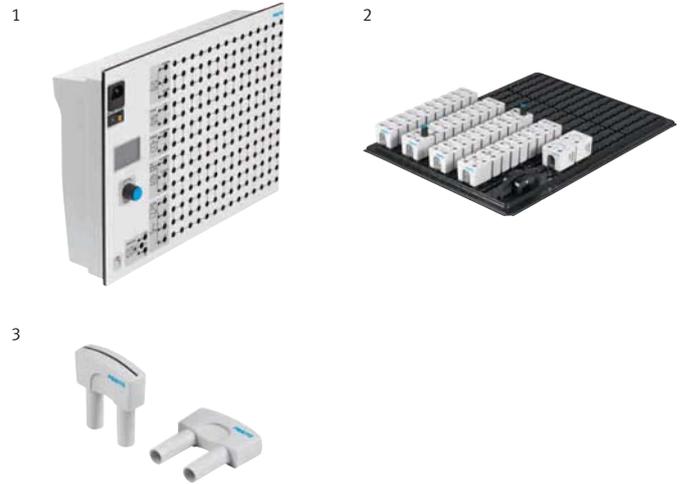
IEC power cable → Page 239
4 mm Safety laboratory cables → Page 247
2x Digital multimeter → Page 250
Digital storage oscilloscope → Page 252

Possibilities of expansion:

PSURemote Software, de/en	574179
Set of components for digital technology	574193

Recommended training media, also order:

Fundamentals of direct current technology: Workbook → Page 169
Fundamentals of alternating current technology: Workbook → Page 169



### The setting and measurement software for TP 1010, TP 1011 and TP 1011 M

Also order:

#### PSURemote Software

Software incl. USB cable for PC-supported setting and measurement with the basic power supply unit EduTrainer®.

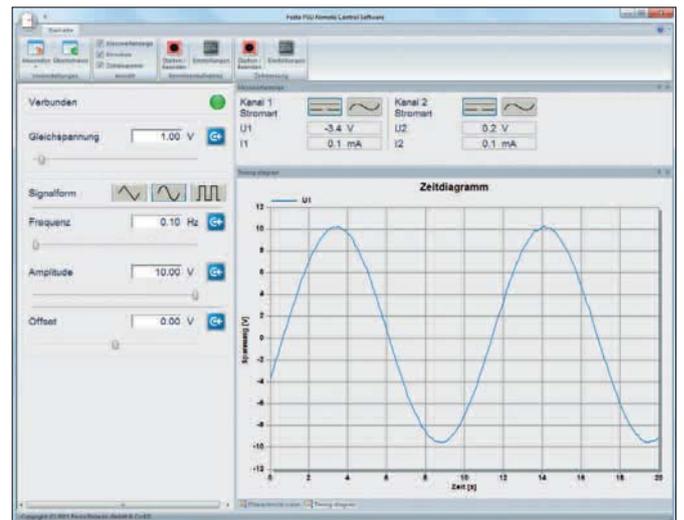
Basic functions:

- Setting the variable DC output
- Setting the signal shape, frequency, amplitude and offset of the frequency generator
- Saving and recalling parameter sets

Also with the built-in measuring

- module on the power supply unit:
  - Direct measured value indicator for voltage and current inputs
  - Recording of measured values over time
  - X-Y comparison of measured values
  - Automatic curve recording with configurable DC voltage output

USB cable with angled USB plug on power supply side, length: 2 m



# Equipment set TP 1012

## Basic principles of digital technology



### The perfect introduction to digital technology

The training package Basic principles of digital technology provides the optimum introduction to the world of digital signal processing. Those who learn and understand digital technology can easily and quickly learn any automation programming language.

The basic principles of digital technology include logical operations, signal flow and data formats. The curriculum also includes structured procedures for problem solving.

### Special characteristics

- The components of the training package are constructed with real logic gates. They permit realistic examinations of their behaviour.
- The ICs contained in the components have a base and can be exchanged in only a few steps.
- All parts of the equipment set are completely equipped with safety plug connections.
- The Combiboard Digital and Control Technology EduTrainer® included with this training package provides the required supply voltages for all tests and also contains a square-wave generator with 7 different output frequencies.
- This Combiboard EduTrainer® can also be used as a patch panel for the components of the control technology equipment set.

### Components included

- 1 inverter
- 2 AND
- 2 OR
- 1 NAND
- 1 NOR
- 1 XOR
- 1 hex switch and analogue source 0 – 5 V
- 1 LED bar graph
- 1 counter
- 1 7-segment display
- 1 RS flip-flop
- 2 JK flip-flops
- 2 shift registers
- 1 full adder
- 1 signal input

### Training content

- Elementary logic modules
- Important symbols
- Designing and optimising logical circuits
- Logic algebra
- Conjunctive and disjunctive standard format
- Switching matrix diagrams
- Schmitt trigger
- Hysteresis
- Types of trigger circuits
- Using flip-flops
- Counting circuits
- Converting and transferring data
- Shift register
- Data conversion
- Arithmetic circuits

Complete equipment set TP 1012 **8023961**

The most important components at a glance:

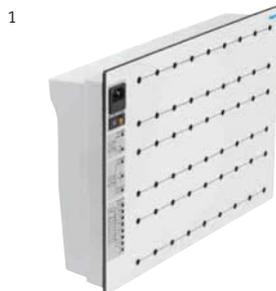
1	1x Combiboard Digital and control technology EduTrainer	8023962
2	1x Set of components for digital technology	574193

Necessary accessories, also order:

IEC power cable → Page 239
2 mm Safety laboratory cables → Page 247

Possibilities of expansion:

I/O level converter 5 V ↔ 24 V	576622
IC zero insertion force socket	576623
Set of components for control technology	8023963



Also order:

**Workbook**



The exercises in the workbook contain concrete, realistic projects with problem descriptions, parameters and project tasks.

The workbook contains:  
 – Sample solutions  
 – Educational instructions  
 – Multimedia CD-ROM with graphics  
 – Worksheets for learners

The worksheets support the learner in the information and planning phase as well as with execution, monitoring and documentation.

All exercises require independent performance, evaluation and documentation from the learner.

Campus licence (→ Page 53):

de	<b>8023432</b>
en	<b>8023433</b>
es	<b>8023434</b>
fr	<b>8023435</b>



**I/O level converter 5 V ↔ 24 V**  
 I/O level converter for the implementation of digital inputs and outputs for digital technology or microcontrollers on functional models.  
 – Supply voltage DC/24 V via 4 mm safety plug  
 – 8 inputs 5 V via 2 mm safety plug, 8 outputs 5 V via 2 mm safety plug  
 – SysLink connection with 8 inputs and 8 outputs 24 V  
 – Acceptable current load per DC/24 V output 300 mA, protected against short circuits and overloads  
 – Sum of the output currents: max. 2 A  
 Order no. **576622**



**IC zero insertion force socket**  
 High-quality IC socket for tool-free adaptation of ICs, compatible with digital technology.  
 – 16 pins in a 2.54 mm grid  
 – Tool-free assembly using clamping lever  
 – Contacting with 2 mm safety plug  
 Order no. **576623**

# Equipment set TP 1013

## Basic principles of control technology



### Control technology explained simply and comprehensibly

The training package Basic principles of control technology provides a fast and easy-to-understand introduction to the topic of controllers and controlled systems.

The basic terminology of control technology, the behaviour of various controllers and the structured analysis of requirements for controlled systems are particularly important here.

Ways and means of analysing and solving control problems are shown and looked at in depth through experiments during the projects.

The equipment set permits fast and flexible construction of different controllers and thus allows simple inspections of behaviour based on the interaction with controlled systems of different types.

All parts of the equipment set are completely equipped with safety plug connections. The Combiboard Digital and Control Technology EduTrainer® contained in the equipment set provides the required supply voltages for all tests and also contains a square-wave generator with 7 different output frequencies. This Combiboard EduTrainer® is also used in the training package Digital technology.

### Components included

- 1x 2 differential inputs with subtractor
- 1x P element
- 1x I element
- 1x D element
- 1x summer with adjustable offset
- 1x limiter with level adaptation of the output signals
- 1x comparator with hysteresis and switching output
- 2x controlled system

### Training content

- Structure of a control circuit
- Spring response, dynamic behaviour
- Standardising physical variables
- Bode diagram
- Modelling a controlled system
- Positive and negative feedback
- Two and three-step action controller
- P, I and PID controllers
- Stable and unstable behaviour
- Controller gain
- Delay behaviour according to Ziegler and Nichols

Complete equipment set TP 1013 **8023964**

The most important components at a glance:

1	1x Combiboard Digital and control technology EduTrainer	8023962
2	1x Set of components for control technology	8023963

Necessary accessories, also order:

IEC power cable → Page 239
2 mm Safety laboratory cables → Page 247
Digital storage oscilloscope → Page 252

Possibilities of expansion:

Set of components for digital technology	574193
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1



2



Also order:

### Workbook



The exercises in the workbook contain concrete, realistic projects with problem descriptions, parameters and project tasks.

The workbook contains:

- Sample solutions
- Educational instructions
- Multimedia CD-ROM with graphics
- Worksheets for learners

The worksheets support the learner in the information and planning phase as well as with execution, monitoring and documentation.

All exercises require independent performance, evaluation and documentation from the learner.

Campus licence (→ Page 53):

de	<b>8023436</b>
en	<b>8023437</b>
es	<b>8023438</b>
fr	<b>8023439</b>

# Equipment set TP 1111

## Power supply systems and protective measures



### Fundamentals of electrical protective measures

Protecting people plays an important role when using electrical energy, as it is not visible and is recognisable only by its effects. Possible risks must therefore be minimised through suitable safety measures.

Examples provide an introduction to the problems associated with electrical safety measures. Current conditions are examined and the risks resulting from the relevant situation are demonstrated by means of measurements. The subsequent analysis and interpretation of the measurement results show the relationships and identify measures.

### Training content

- Power supply:
- Power supply systems (TN, TT, IT system)
  - Protective measures in the different networks
- Service connection:
- Components of a service connection system
  - Additional designations in the TN system (TN-C, TN-S, TN-C-S)
  - Selection of the protective measure and protective devices
  - Protective measure measuring devices
  - Planning and execution of initial tests in accordance with DIN VDE 0100-610 and repeat tests in accordance with DIN VDE 0105 and BGV A3
  - Creating test reports
  - Safety and availability advice for customers

### Sub-distribution:

- Using protective measures and measuring devices
- Planning and execution of initial and repeat tests
- Evaluation of the measurement results
- Creating test reports
- Identifying, describing and measuring risks due to errors
- Systematic troubleshooting

### General:

- Conducting customer dialogues
  - for system commissioning
  - for repeat testing
  - for errors/malfunctions in the electrical system
- following successful repair

### Advantages

- Lockable error switches integrated in the housing facilitate realistic fault finding
- No additional power supply required
- Complete teaching materials including WBT Electrical safety measures
- For a practical explanation of the protective measures, measurements and tests are carried out using conventional test and measuring devices.
- The optionally available Systainer solution meets work, transport and storage requirements efficiently.

Complete equipment set TP 1111 **571824**

The most important components at a glance:

1	1x EduTrainer net board	571825
2	1x EduTrainer house installation	571826
3	1x EduTrainer subdistributor	571827

Necessary accessories, also order:

4 mm Safety laboratory cables → Page 247
Safety jumper plugs → Page 248
Installation tester for VDE 0100 → Page 251

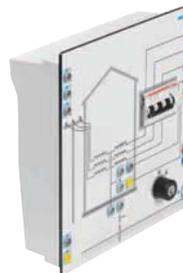
Possibilities of expansion:

Selective RCD EduTrainer → Page 178	574173
RCD A/B EduTrainer → Page 178	574174
IT network EduTrainer → Page 179	574178

Recommended training media, also order:

Electrical protective measures: WBT → Page 17
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1



2



3



Also order:

### Workbook



The exercises in the workbook contain concrete, realistic projects with problem descriptions, parameters and project tasks.

The workbook contains:

- Sample solutions
- Educational instructions
- Multimedia CD-ROM with graphics
- Worksheets for learners

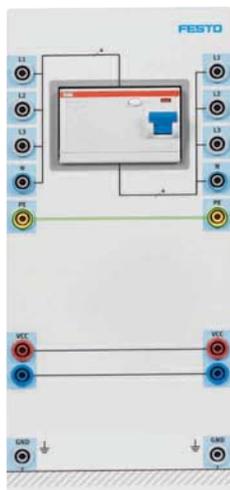
The worksheets support the learner in the information and planning phase as well as with execution, monitoring and documentation.

All exercises require independent performance, evaluation and documentation from the learner.

Campus licence (→ Page 53):

de	<b>567307</b>
en	<b>567309</b>
es	<b>567311</b>
fr	<b>567313</b>

## Selective RCD EduTrainer®



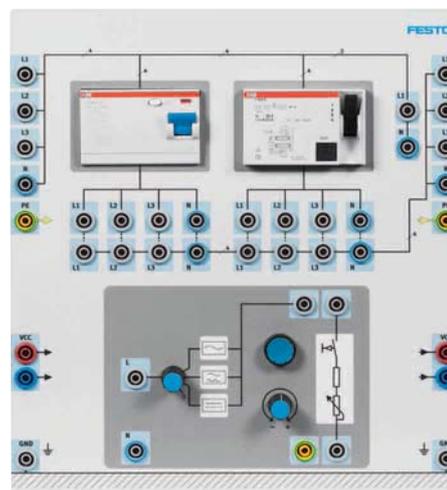
The Selective RCD EduTrainer® allows for treatment of the topic of selectivity for residual current circuit breakers in mains systems and protective measures. The selective RCCB ideally supplements the RCD A/B EduTrainer®, so that it can be easily integrated and its essential characteristics can be elaborated.

The locations of all connections are standardised and are laid out as safety sockets.

### Technical data

- Input voltage: 3 x 400 V AC
- Output voltage: 3 x 400 V AC
- Front panel: 133 x 297 mm
- Console housing with rubber feet for use in an A4 frame or on a table
- Connection via 4 mm safety plugs

## RCD A/B EduTrainer®



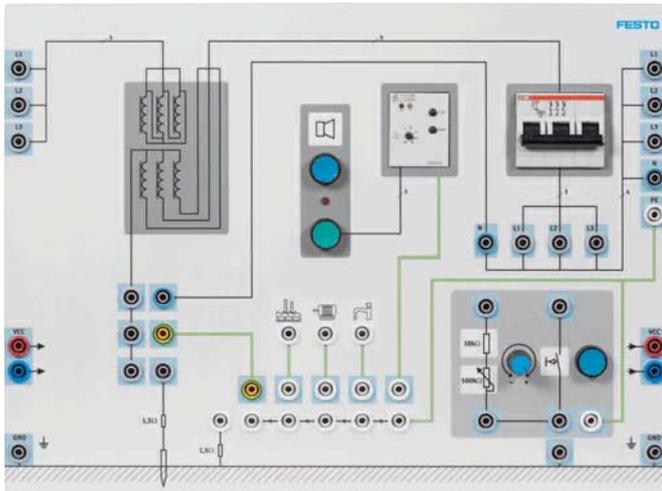
The RCD A/B EduTrainer® covers the topic of residual current circuit breakers in mains systems and protective measures. The two basic types of RCD, type A and type B, are compared with each other and their essential characteristics can be elaborated. The board is equipped with a fault simulator at which various types of voltage can be selected for the simulation of leakage current including alternating voltage, pulsed direct voltage and smoothed direct voltage. An additional voltage tap for downstream circuit breakers/RCCBs enables optimal integration into the equipment set for mains systems and protective measure.

The locations of all connections are standardised and are laid out as safety sockets.

### Technical data

- Input voltage: 3 x 400 V AC (50 Hz)
- Output voltage: 3 x 400 V AC
- Tap for downstream circuit breakers/RCCBs
- Pushbutton and adjustment potentiometer for fault simulation
- Voltage type for leakage current can be set to alternating voltage, pulsed direct voltage or smoothed direct voltage
- Max. leakage current: approx. 40 mA, option for looping in an ammeter
- Front panel: 266 x 297 mm
- Console housing with rubber feet for use in an A4 frame or on a table
- Connection via 4 mm safety plugs

# IT network EduTrainer®



The IT network EduTrainer® expands the equipment set for mains systems and protective measures to include the topic of IT systems. The integrated fault simulator allows simulation of insulation faults which are detected and displayed by the insulation monitor. If the adjustable value is fallen short of, this is indicated by a lamp, as well as a buzzer which can be acknowledged.

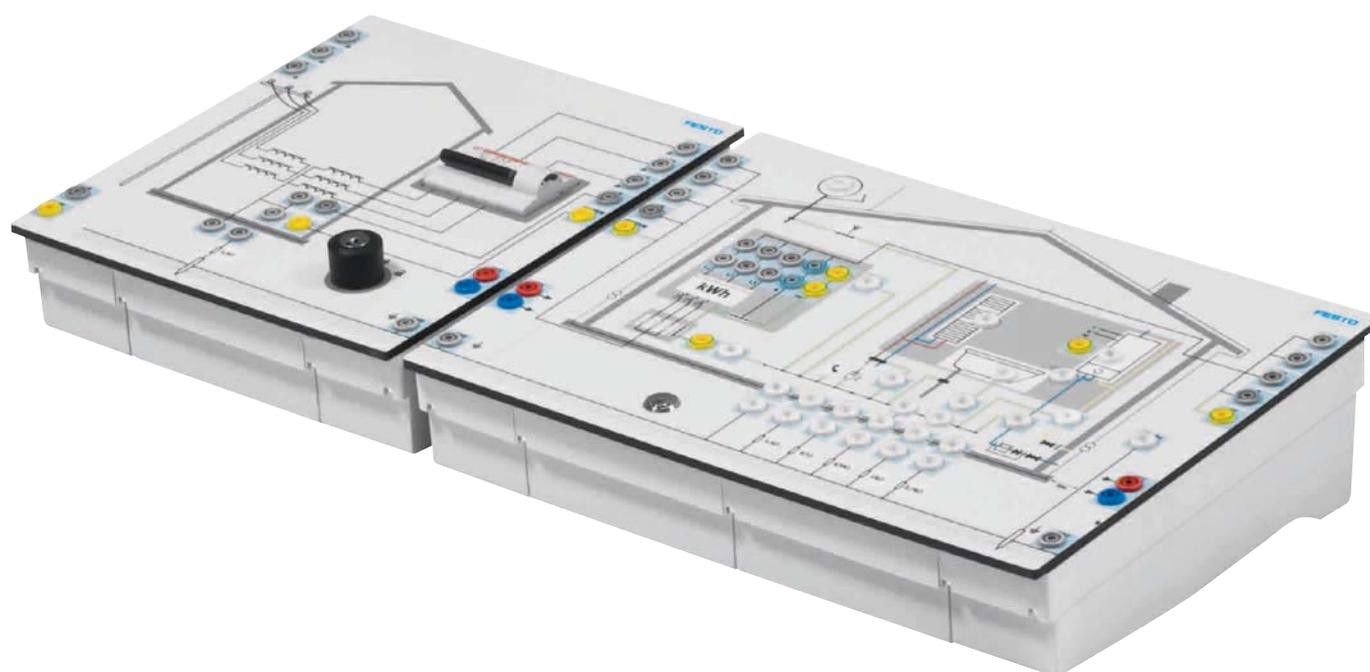
The locations of all connections are standardised and are laid out as safety sockets.

#### Technical data

- Input voltage: 3 x 400 V AC
- Output voltage: 3 x 400 V AC
- Output current: max. 1 A
- Front panel: 399 x 297 mm
- Console housing with rubber feet for use in an A4 frame or on a table
- Connection via 4 mm safety plugs

## Equipment set TP 1110

### Electrical safety measures for metalworking occupations



#### Sensitising people to hazards: The electrical safety measures for metalworking occupations

The aim of protective measures is to protect persons and machines from harm.

Special rules must be followed when dealing with electrical energy, because electrical energy is recognisable only by its effects.

This training package provides an introduction to the topic of electrical protective measures. It explains where and why dangers arise even in a mechanic's range of activities and how they can be avoided.

The training package uses numerous examples to illustrate the particular issues of dangers due to electrical energy and explains the necessary protective measures.

The exercises require the current conditions to be examined and the dangers resulting from the particular situation to be demonstrated by means of concrete measurements.

The subsequent analysis and interpretation of the measurement results show the relationships and justify the protective measures taken.

#### Training content

Mains supply:

- Power supply systems (TN, TT, IT system)
- Safety measures in the different networks

Service connection:

- Components of a service connection system
- Additional designations in the TN system (TN-C, TN-S, TN-C-S)
- Selection of the safety measure and protective devices
- Safety measure measuring devices
- Initial tests acc. DIN VDE 0100-610 and repeat tests acc. DIN VDE 0105 and BGV A3

#### Benefits

- Lockable error switches integrated in the housing facilitate realistic fault finding
- No additional power supply required
- Complete teaching materials including WBT Electrical safety measures
- For a practical explanation of the safety measures, measurements and tests are carried out using conventional test and measuring devices.
- The optionally available Systainer solution meets work, transport and storage requirements efficiently

Complete equipment set TP 1110 **8023971**

1

The most important components at a glance:

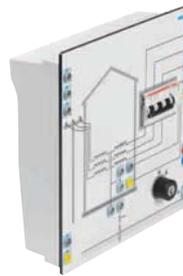
1	1x EduTrainer net board	571825
2	1x EduTrainer house installation	571826

Necessary accessories, also order:

4 mm Safety laboratory cables	→ Page 247
Safety jumper plugs	→ Page 248
Installation tester	→ Page 251

Recommended training media, also order:

Electrical protective measures: WBT	→ Page 17
-------------------------------------	-----------



2



Also order:

### Workbook



The exercises in the workbook contain concrete, realistic projects with problem descriptions, parameters and project tasks.

The workbook contains:

- Sample solutions
- Educational instructions
- Multimedia CD-ROM with graphics
- Worksheets for learners

The worksheets support the learner in the information and planning phase as well as with execution, monitoring and documentation.

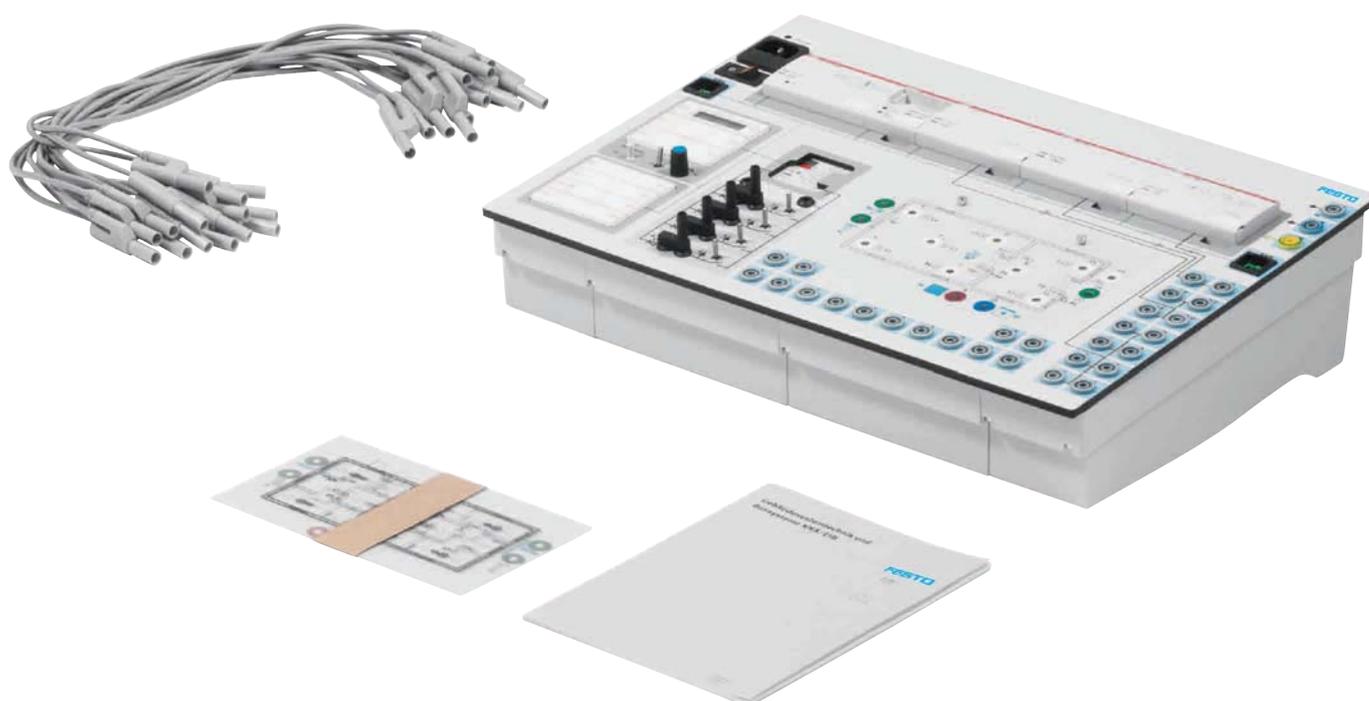
All exercises require independent performance, evaluation and documentation from the learner.

Campus licence (→ Page 53):

de	<b>8023440</b>
en	<b>8023441</b>

# Equipment set TP 1131

## KNX/EIB compact board



### Intelligent solutions

Modern buildings are characterised by intelligent lighting and air-conditioning solutions. Building automation systems and bus systems play a key role here.

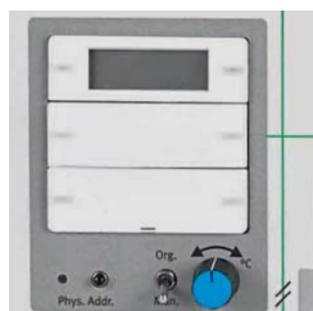
The KNX/EIB compact board Edu-Trainer® is used to explain use of this technology. Equipped with the latest generation of industrial components, it delivers state-of-the-art technology.

When selecting the devices used, efforts were made to ensure that the widest possible range of levels of complexity can be realised. Beginners are therefore not overwhelmed and can use the full range of functions to meet increasing requirements.

The optionally available Systainer solution meets work, transport and storage requirements efficiently, thus reducing the amount of work required before and after lessons.

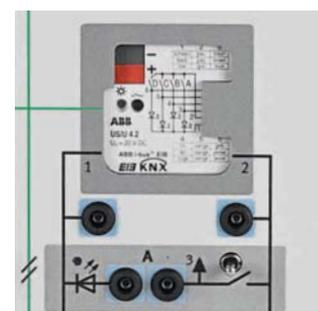
### Training content

- KNX/EIB system fundamentals
- Using the system software ETS4
- Switching and dimming the light
- Two-way circuits
- Interval timers
- Staircase lighting timers
- Light scene control systems
- Different floor plans
- Heating and climate control
- Louvre and blind control systems
- Logic operation of signals



### Functional

The pushbutton sensor elements can be used either as rockers or as independent buttons, the actual value of the integrated temperature controller can be specified and further processed using an external potentiometer.



### Universal

The channels of the 4-fold universal interface can be parameterised as both binary input and outputs. This means, for example, that the LEDs can be used to indicate a wide variety of states or solid state relays can be controlled for electrothermal heating valve drives.

Complete equipment set TP 1131 **571867**

#### Scope of delivery

- KNX/EIB compact board
- Overlay masks
- 14 laboratory safety cables

Recommended accessories, also order:

KNX cable set 8023965

Possibilities of expansion:

KNX EduTrainer heating actuator	574175
KNX EduTrainer line connector	574176
KNX EduTrainer louvre	574177
KNX EduTrainer universal experimental board	8023966
KNX IP/WLAN function package	8023967
KNX logic/time function package	8023968
KNX room climate function package	8023969
KNX energy function package	8023970

#### Technical data

- Input voltage: 1 AC/230 V AC (50 Hz), short circuit and overload protection
- Phase display
- Output for the connection of additional KNX/EIB EduTrainer® modules
- Output voltage: 1 AC/230 V AC
- Integrated power supply unit 30 V DC 0.16 A
- USB interface
- 8-fold switching output
- 2-fold louvre actuator
- 2-fold dimming actuator
- 4-fold universal binary I/O
- 4-fold multi-function pushbutton sensor with 8 pushbuttons

- 2-fold multi-function pushbutton sensor with 4 pushbuttons, room temperature controller including setpoint and actual value input and display
- Integrated simulation panel with 14 colour LEDs, some dimmable
- KNX system connector for bus connection
- Connection via 4 mm and 2 mm safety connectors
- Front plate: 399 x 297 mm
- Control console housing with rubber feet for use in A4 frame or on tabletop

Also order:

#### The workbook

Building automation with KNX targets the topic of automation of a building based on KNX components. Focus is laid on the software tools, equipment and configuration as well as their interaction and extended options, all of which are addressed through realistic situations.

Particular emphasis is placed on independent execution, evaluation and documentation by the student.

Worksheets support the students through the required stages of introduction, planning and execution of exercises up to the evaluation of results and documentation.

The workbook contains:

- Sample solutions
- Training notes
- Multimedia CD-ROM with graphics
- Worksheets for learners

Campus licence (→ Page 53):

de	<b>8023444</b>
en	<b>8023445</b>
es	<b>8023446</b>



#### Recommended training media, also order:

KNX manual on house and building systems technology

de	576265
en	576269

KNX Basic course documentation

de	576266
en	576270

KNX Advanced course documentation

de	576267
en	576271

KNX Training documentation

de	576268
en	576272

## KNX EduTrainer® heating actuator



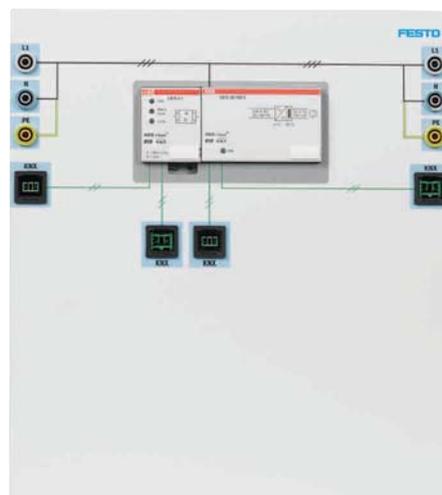
The heating actuator controls the heating water circuits in heating systems. The interior of the valve is visible, and an integrated gauge shows the stroke of the plunger. The valve is supplied entirely via the KNX bus. Two binary inputs are available as presence and/or window contacts and can be controlled via switches or external signals. The plate also contains the KNX system distributor for 230 V.

The locations of all connections are standardised and are routed to safety sockets or system plugs.

### Technical data

- Input voltage: 1 x 230 V AC
- Output voltage: 1 x 230 V AC
- Electric motor functional principle, automatic limit stop connection, controller stroke 6 mm, run-time < 20 s/mm, control force > 120 N
- Display of valve stroke via LEDs
- Gauge triggering: 0.01 mm
- Front panel: 266 x 297 mm
- Console housing with rubber feet for use in an A4 frame or on a table
- Connection via 4 mm safety plugs
- Connections for KNX bus via KNX bus plug connectors

## KNX EduTrainer® line connector



The line connector connects the main and secondary line in a KNX systems. This also permits targeted filtering of signals. The main line is also equipped with a power supply. The plate also contains the KNX system distributor for 230 V.

The locations of all connections are standardised and are routed to safety sockets or system plugs.

### Technical data

- Input voltage: 1 x 230 V AC
- Output voltage: 1 x 230 V AC
- Power supply EIB: 30 V, DC 160 mA
- Front panel: 266 x 297 mm
- Console housing with rubber feet for use in an A4 frame or on a table
- Connection via 4 mm safety plugs
- Connections for KNX bus via KNX bus plug connectors

## KNX EduTrainer® louvre



The louvre is used to emulate situations in building automation. For this purpose, the louvre can be raised or lowered and the slat position can be influenced. The connections for controlling “UP” and “DOWN” are routed to 4 mm safety sockets. The plate also contains the KNX system distributor for 230 V.

The locations of all connections are standardised and are routed to safety sockets or system plugs.

### Technical data

- Input voltage: 1 x 230 V AC
- Output voltage: 1 x 230 V AC
- Louvre: Length 440 mm, stroke 160 mm
- Power consumption: 100 W, current max. 0.45 A
- Front panel: 399 x 297 mm
- Console housing with rubber feet for use in an A4 frame or on a table
- Connection via 4 mm safety plugs
- Through-feed for KNX bus via compact KNX bus plug connectors
- Connection option for the louvre control to the KNX compact board via jumper plugs

## KNX EduTrainer® universal experimental board



The universal experimental board serves to integrate KNX bus devices of all kinds into the KNX learning system.

It makes it possible to integrate rail mounted devices and surface-mounted and flush-mounted devices. Both an operating voltage supply and bus connections are available for electrical connection of the equipment. The outputs are routed to positions suitable for the system. Two sockets make it possible to supply external equipment with voltage. In addition, the panel contains the KNX system distribution for 230 V. The locations of all connections are standardised and are routed to safety sockets or system plugs.

### Technical data

- Input voltage: 230 V AC
- Output voltage: 230 V AC
- 2 plug socket outlets for 230 V AC
- 7 output connections
- Front panel: 399 x 297 mm
- Console housing with rubber feet for use in an A4 frame or on a table
- Connection via 4 mm safety plugs
- Connections for KNX bus via KNX bus plug connectors

### Theme-based KNX function packages:

#### KNX IP/WLAN function package

- KNX IP router
- WLAN access point

#### KNX logic/time function package

- Logic module

#### KNX room climate function package

- Air quality sensor

#### KNX energy function package

- Energy actuator

Each function package consists of the KNX component and the necessary accessories.

Order no.

574177

Order no.

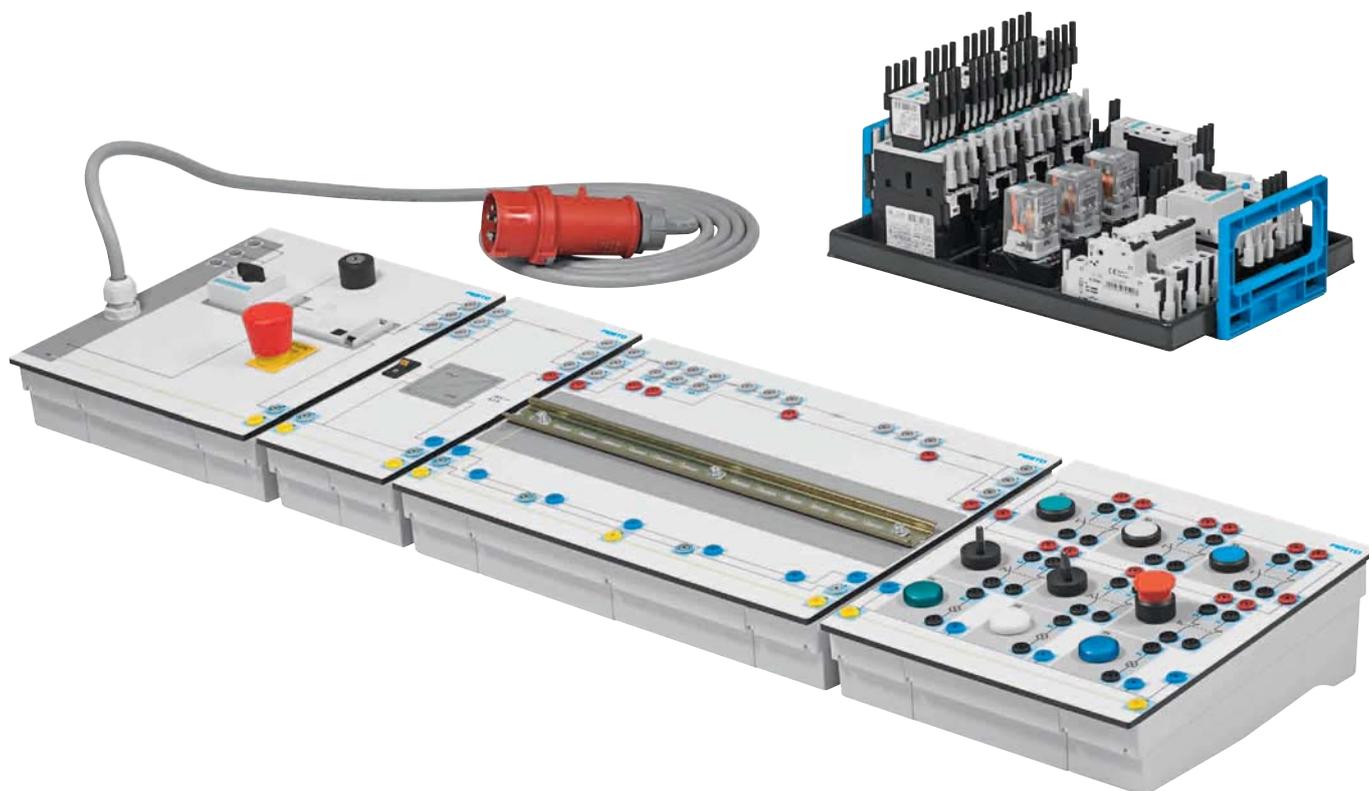
8023966

Theme-based KNX function packages:

KNX IP/WLAN function package	8023967
KNX logic/time function package	8023968
KNX room climate function package	8023969
KNX energy function package	8023970

# Equipment set TP 1211

## Basic principles of circuits with contacts



### Basic principles of control technology

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.

### Training content

- Pushbuttons and switches
- N/O and N/C contacts
- Jog mode
- Self-latching loop
- Pushbutton lock
- Multiple control points
- Messages
- Design and function of a contactor
- Electronic time relays
- Overcurrent trigger and motor protection switch
- Equipment designations
- Connecting and testing a three-phase socket
- Main and control circuit
- Protective interlocking
- Reversing contactor circuit
- Star-delta starting up
- Reversing contactor circuit with automatic star-delta starting up

### Advantages

- The three-phase AC supply guarantees the electrical safety of the workplace
- Extremely compact equipment
- Flexible thanks to the use of industrial components
- Easily expandable
- Jumper plugs for connecting the boards improve clarity
- Maximum effectiveness in combination with MPS® transfer line or electric machines
- Stable angled screw-in sockets for contacting
- The optional Systainer solution combines work, transport and storage requirements perfectly, thus reducing the amount of work required before and after lessons

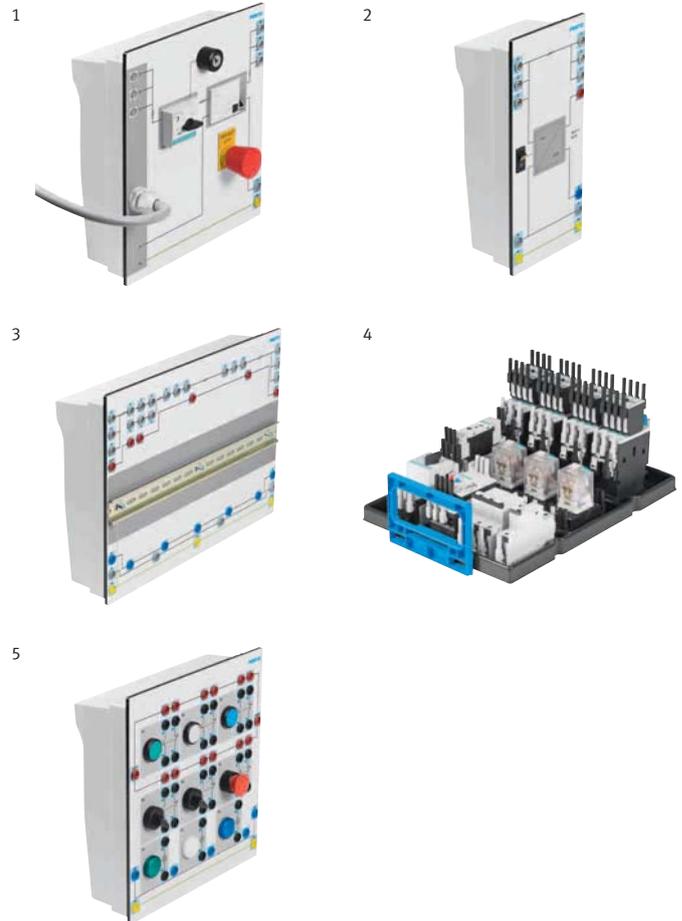
Complete equipment set TP 1211 **571811**

The most important components at a glance:

1	1x EduTrainer three-phase current supply	571812
2	1x EduTrainer 24 V power supply unit	571813
3	1x EduTrainer contactor board	571814
4	1x Motor technology contactor set	571816
5	1x EduTrainer operator and signalling unit	571815

Recommended accessories, also order:

4 mm Safety laboratory cables, 106 pieces, red, blue and black	571806
4 mm Safety laboratory cables, 52 pieces, grey and green-yellow	571807
Safety jumper plugs → Page 248	
Electric machines → Page 190	
Amprobe DR 705 phase sequence indicator	571835
MPS Transfer system → Pages 274 – 285	



Also order:

#### Workbook



The exercises in the workbook contain concrete, realistic projects with problem descriptions, parameters and project tasks.

The workbook contains:

- Sample solutions
- Educational instructions
- Multimedia CD-ROM with graphics
- Worksheets for learners

The worksheets support the learner in the information and planning phase as well as with execution, monitoring and documentation.

All exercises require independent performance, evaluation and documentation from the learner.

Campus licence (→ Page 53):

de	<b>570901</b>
en	<b>567315</b>
es	<b>567317</b>
fr	<b>567319</b>

# Equipment set TP 1410

## Servo brake and drive system



### Electric drive technology

Modern drives are characterised by the bringing together of electrical and mechanical components to create complete systems.

With rotating electric machines in particular, the basic principles of the individual components along with the system approach and practicality play a crucial role.

Enclosed in a compact housing, this equipment set incorporates a complete, flexible and convenient load and drive system, which is used to analyse the systems to be examined in different load situations.

The unique didactic concept makes a clear distinction between the unit under test and the load. The practical quick-change system makes it easy to set up and change the machines to be examined. The unit under test circuits are created using reliable and flexible A4 EduTrainer® modules.

Simple tests such as the recording of a characteristic curve can be performed manually with the brake system, with no need for a PC and software. Measured values, characteristics and function mode are shown on the integrated display.

The convenient **DriveLab** software provides a wide range of options.

With the electric teaching machines, virtually all electric circuits and drives that exist in industry, in trade and in the home can be explained practically and effectively.

The range of drives includes systems of varying degrees of complexity, including single-phase and three-phase drives, DC drives and modern servo drives.

### Training content

- Electric drive technology components
- DC drives
- AC drives
- Three-phase drives
- Special purpose machines
- Actuation with contact
- Frequency converters
- Communication technology

### Technical data

- Input voltage: 1 AC/110 – 230 V, 50 – 60 Hz
- Control console housing with rubber feet for use in the desk
- Connection via 4 mm safety connector
- Integrated EMC filter
- Integrated braking resistor

### Scope of delivery

- Servo brake and drive system
- Transparent shaft cover
- Coupling sleeve
- DriveLab software
- USB connecting cable

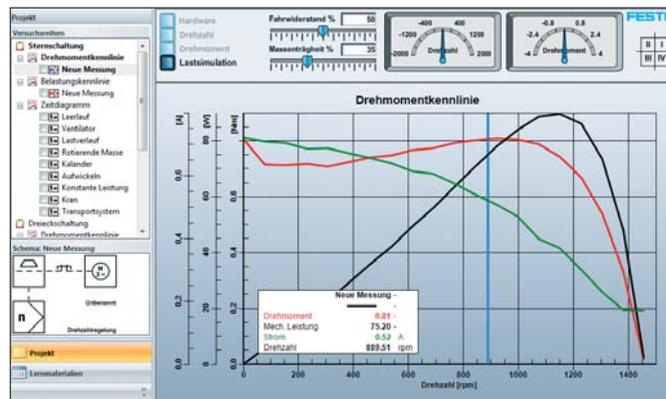
Complete equipment set TP 1410 **571870**

Possibilities of expansion:

EduTrainer three-phase current supply	571812
EduTrainer 24 V power supply unit	571813
EduTrainer contactor board	571814
Motor technology contactor set	571816
EduTrainer operator and signalling unit	571815
Electric machines → Page 190	
Motor protection switch → Page 191	
EduTrainer AC measurement board	576616
Micomaster 420 EduTrainer	8036812
Sinamics G120 EduTrainer → Page 194	
EduTrainer regulating transformer	8037127
EduTrainer field rheostat	8036772
EduTrainer load resistance	8037136
EduTrainer motor switches	576309
EduTrainer plug sockets	8023972

Recommended training media, also order:

Electric drives 1: WBT → Page 22
Electric drives 2: WBT → Page 22



The convenient and intuitive **Drive-Lab** software supports the automatic recording of machine characteristic curves, the parameterisation of a static load and the simulation of load models for the examination of drives under realistic conditions. The comparison and optimisation of different drive concepts can be carried out in the form of project exercises. Sample configurations provide a quick and easy-to-understand introduction.

Different load models

- Inert load
- Pump/fan
- Hoist drive
- Calendar
- Winder drive
- Lathe
- Traversing drive

Also order:

**Workbooks**

The exercises in the workbooks contain concrete, realistic projects with problem descriptions, parameters and project tasks.

- The workbooks contain:
- Sample solutions
  - Educational instructions
  - Multimedia CD-ROM with graphics
  - Worksheets for learners

The worksheets support the learner in the information and planning phase as well as with execution, monitoring and documentation.

All the exercises require the learner to complete, evaluate and document them independently.

**Fundamentals of DC machines**

Campus licence (→ Page 53):

de	571781
en	571783
es	571785

**Fundamentals of AC machines**

Campus licence (→ Page 53):

de	571789
en	571791
es	571793

**Fundamentals of three-phase current machines**

Campus licence (→ Page 53):

de	571797
en	571799
es	571801
fr	571803



# Electric machines



- Sturdy special design for training purposes
- Neutral rating plate
- Overtemperature protection (NC contact) in the winding
- Fully assembled and aligned on support plate
- One shaft end, equipped with coupling piece suitable for the servo brake and drive system
- Support plate with clamping slot and quick action mounting system for profile plate
- All connections on safety sockets
- Painted in RAL 7035

- 1 DC shunt machine**
- Power rating: 0.3 kW
  - Speed: 2,000 rpm
  - Armature: 220 V/1.8 A
  - Field: 220 V/0.3 A

- 2 DC series machine**
- Power rating: 0.3 kW
  - Speed: 2,000 rpm
  - 220 V/1.9 A

- 3 Universal motor**
- Power rating: 0.2 kW
  - Speed: 3,000 rpm
  - AC 230 V/3.0 A
  - DC 140 V/2.5 A

- 4 Capacitor motor**
- Power rating: 0.25 kW
  - Speed: 1,400 rpm
  - cos φ: 0.99
  - AC 230 V/1.86 A
  - Running/starting capacitor: 25 μF/10 μF

- 5 Three-phase current asynchronous motor 230/400 V**
- Power rating: 0.25 kW
  - Speed: 1,350 rpm
  - cos φ: 0.79
  - Star circuit: 400 V/0.76 A
  - Delta circuit: 230 V/1.32 A

- 6 Three-phase current asynchronous motor 400/690 V**
- Power rating: 0.25 kW
  - Speed: 1,350 rpm
  - cos φ: 0.78
  - Star circuit: 690 V/0.45 A
  - Delta circuit: 400 V/0.77 A

- 7 Synchronous machine**
- Power rating: 0.3 kW
  - Speed: 1,500 rpm
  - cos φ: 0.97
  - Exciter: 150 V/0.95 A
  - Star circuit: 400 V/0.66 A
  - Delta circuit: 230 V/1.14 A

- DC compound machine**
- Output: 0.3 kW
  - Speed: 2000 r.p.m
  - Armature: 220 V/1.8 A
  - Field: 205 V/0.25 A

- Three-phase AC multifunction machine (AC slip ring rotor, can be synchronised)**
- Output: 0.27 kW
  - Speed: 1360/1500 r.p.m. 50 Hz
  - cos φ: 0.7/1.0
  - Star connection: 400 V/0.83 A
  - Delta connection: 230 V/1.44 A
  - U<sub>2</sub>: AC 107 V/1.7 A; DC 20 V/4.0 A

- Dahlander**
- Output: 0.3/0.43 kW
  - Speed: 1390/2800 r.p.m 50 Hz
  - cos φ: 0.73/0.8
  - Double star circuit: 400 V/1.2 A
  - Delta connection: 440 V/0.89 A

- 11 Slip ring rotor**
- Output: 0.27 kW
  - Speed: 1360 r.p.m 50 Hz
  - cos φ: 0.72
  - Star connection: 400 V/1.16 A
  - Delta connection: 230 V/2 A
  - U<sub>2</sub>: 95V

Further machines are available on request.

1	DC shunt machine	571868
2	DC series machine	571869
3	Universal motor	571871
4	Capacitor motor	571872
5	Three-phase current asynchronous motor 230/400 V EMC	8041448
5	Three-phase current asynchronous motor 230/400 V	571874
6	Three-phase current asynchronous motor 400/690 V EMC	8041449
6	Three-phase current asynchronous motor 400/690 V	571875
7	Synchronous machine	572095
	DC compound machine	8023977
	Three-phase AC multifunction machine	8023978
	Dahlander	8023979
11	Slip ring rotor	8023980

## Motor protection switch



High-quality, industrial switching device from Siemens with 4 mm safety elbow adapters for professional protection of rotating electric machines.

### Technical data

- Mounting on 35 mm H-rail
- Auxiliary contacts
  - 1 N/O contact + 1 N/C contact

Available with the following values:

- 0.35 – 0.5 A
- 0.55 – 0.8 A
- 1.1 – 1.6 A
- 1.8 – 2.5 A
- 2.2 – 3.2 A

## EduTrainer® AC measurement board



The measurement board is designed for measuring the electrical variables of voltage, current, apparent, real and reactive power, power factor and frequency of one- and three-phase loads. Other functions include min-max values, real and reactive energy, dual tariff recording, average power demand MIN/MAX, hours-run meter and energy meter.

The locations of all connections are standardised and are routed to safety sockets or system plugs.

Ethernet port for integration in higher-level systems.

### Technical data

- Supply voltage: 1 AC/95 – 240 V
- Measured voltage:
  - 1 AC/40 – 400 V, 3 AC/40 – 690 V
- Measured current max. 5 A
- Front panel: 133 x 297 mm
- Console housing with rubber feet for use in an A4 frame or on a table
- Connection via 4 mm safety plugs
- Floating switching output and meter input
- Cover cap for Ethernet connection

0.35 – 0.5 A	576284
0.55 – 0.8 A	573266
1.1 – 1.6 A	573267
1.8 – 2.5 A	573268
2.2 – 3.2 A	573269

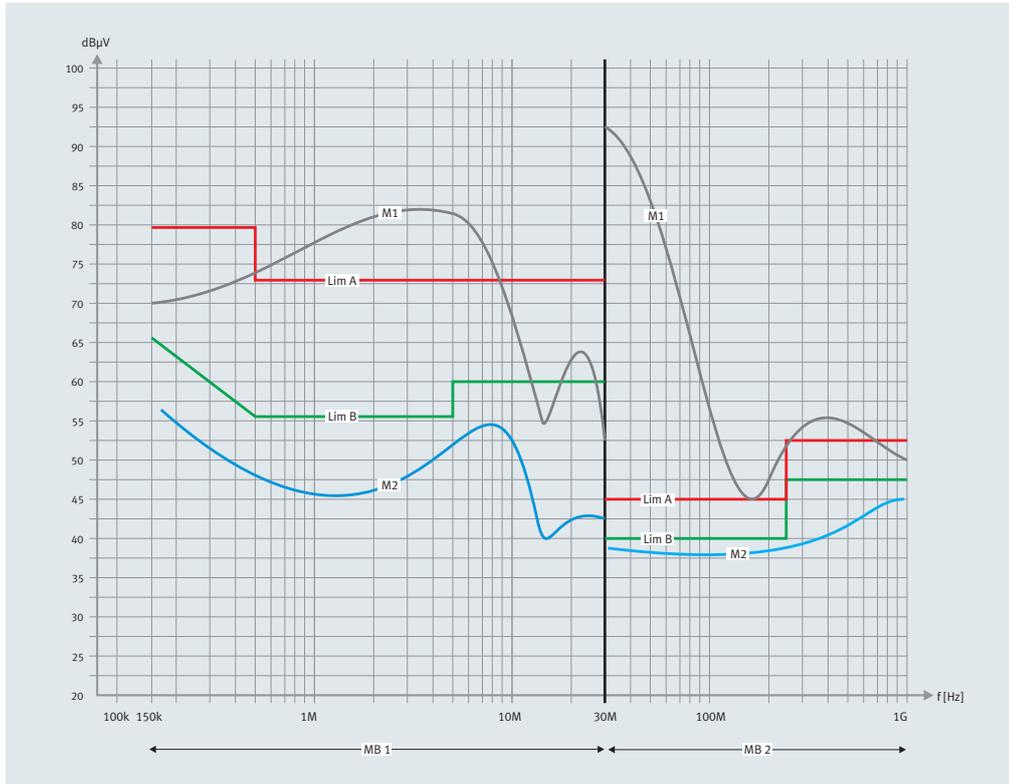
Order no.

576616

# EMC-resistant drive systems

## Information and backgrounds

New



- Key to illustration:
- MB1 (measuring range 1): 150 kHz – 30 MHz, measurement of the conducted emission
  - MB2 (measuring range 2): 30 MHz – 1 GHz, measurement of the radiated emission
  - Lim A: Limit curve per DIN EN 55011, Class A (industrial devices)
  - Lim B: Limit curve per DIN EN 55011, Class B (domestic and small commercial devices)
  - M1: Interference emission without EMC measures
  - M2: Interference emission with EMC measures

The graph shows the two areas of application. The red line shows the limit value for Class A devices, the green line the limit value for Class B devices.

The black curve shows the interference emission for a frequency converter without a housing. The blue curve shows how the interference emission can be significantly reduced with additional measures like filtering, screening, enclosed metal housings and appropriate component arrangements.

### Areas of application

The EMC standards define two areas of application: use in “industrial environments” and in “residential/small company” applications. The industrial environment is characterised by separation of the internal low-voltage grid from the public medium or high-voltage grid via a dedicated transformer. The limits for emitted interference of these industrial devices (Class A devices) are higher than the limits for residential devices (Class B devices) where many independent users are connected to the same low-voltage grid.

### What is EMC?

Modern systems and plants are becoming increasingly technically-demanding, and in particular their electrical components are increasingly complex. In particular the growing amount of power electronics and microelectronics makes ever stricter demands of the components to guarantee trouble free and reliable operation.

EMC stands for “electromagnetic compatibility” and refers to “the ability of an equipment of system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to other equipment in that environment”.

### Resistance to interference and interference emission

In general, a device is examined for both of these phenomena. When testing the resistance to interference, the device is operated and subjected to various defined disturbance variables. These tests include typical electrical phenomena, such as static discharge or surge voltage (lightning strikes) and test for immunity against external interference sources.

By contrast, the emitted interference is tested by operating the device in a condition in which the maximum interference emission is to be expected. The emissions must not exceed a limit specified in the standards.

**CE marking**

EU directives define minimum standards for various product groups which products are required to comply with. The characteristics are entirely different depending on the product group.

Manufacturers use the CE marking to confirm that the device complies with all relevant EU directives. This is confirmed by applying corresponding standards. Devices which do not fulfil the required directives may not bear the CE marking. The market supervisory authority can prohibit sales.

The following EU directives are relevant for CE marking of frequency converters:

- Low Voltage Directive (2006/95/EC)
- EMC (2014/30/EU)
- RoHS (2011/65/EU)

The low voltage directive requires that products do not cause electric hazards.

The EMC directive requires that electric devices must only influence one another to a limited extent.

The RoHS directive requires a limit to hazardous substances such as lead, mercury, cadmium or chrome.



**On the safe side with Festo**

In close cooperation with test laboratories, Festo Didactic has developed the optimal solution for operating frequency converters in training: The EMC-compliant frequency converters are designed to manufacturer's specifications, compact and safe to use.

The new design of the frequency converter fulfils all directives, as is confirmed by the CE marking. That means that the device can be operated safely in all laboratory environments without further measures.

**Your advantages**

Depending on the type of drive tasks, whether simple or complex, a range of frequency converters with suitable motors are available in various designs. The accessories for parameterisation and configuration are also available, as is a test system for measurements and loading the drive systems.

All relevant device interfaces are clearly arranged on a front panel. The control section of the frequency converter can be used there and replaced if necessary.

The motor is connected via a special EMC-compatible cable. The industry plug connector on the cabinet and the shielded clamp on the motor ensure EMC-compatible design of the drive system. The 4 mm safety plug on the motor side also focuses on the didactic aspect.

The interior structure and the consistent shielding concept clearly shows how EMC must be implemented practically. As a result the solution adds didactic value, as important training content on EMC-compliant design is taught.

The devices can be used both in the A4 mounting frame and as table-top devices. Furniture and storage systems for optimal classroom use are also available.

# Sinamics G120 EduTrainer®

New



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 optional encoder input 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 corresponding control panels (BOP-2, IOP) are available as accessories.

### Special characteristics

- Simple parametrisation via START-ER and the BOP-2 or IOP 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 parametrisation interface (mini USB on the converter)
- 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
- Power supply: 3x 400 V AC
- Output: 3x 400 V AC, 0.55 kW

# MicroMaster 420 EduTrainer®

New



The Micromaster 420 frequency converter – Proven technology re-designed. Now in a completely new housing and EMC-compliant for use in laboratories without heeding installation instructions – just like that!

Due to its solid range of functions, it is especially suitable for medium level requirements in converter technology. The PROFIBUS interface also allows it to integrate seamlessly in higher-order control systems.

Complete and ready for operation – all relevant ports are accessible on the front of the device and installed in 4 mm safety sockets. 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 basic operator panel (BOP) is included in the scope of delivery.

### Special characteristics

- Versatile, programmable inputs/outputs
- FCC control (flow current control) for high drive quality, even with load changes
- Multipoint characteristic curve (parametrisable U/f characteristic curve)
- Can be commissioned via control panel or software tool
- Parametrisable acceleration/return times (0 – 650 s)
- 4 suppression frequencies to protect the machine in case of resonance
- Integrated protection/overload functions

### Technical data

- PROFIBUS interface
- BOP (basic operator panel)
- 3 digital inputs
- 1 relay output
- 1 analogue input
- 1 analogue output
- Dimensions (H x W x D): 297 x 266 x 340 mm
- Power supply: 1 AC/230 V
- Output: 3 AC/230 V, 0.25 kW

Sinamics G120 DP	8037819
Sinamics G120 PN	8037820
Sinamics G120 DP-F	8037821
Sinamics G120 PN-F	8037822
Sinamics G120 DP with an encoder port	8037823
Sinamics G120 PN with an encoder port	8037824

Order no.

8036812

# Possibilities of expansion and accessories for frequency converters

New



### Intelligent Operator Panel (IOP)

Powerful operator panel with large plain text display and menu navigation. The application wizard guides you through the startup procedure for important applications. The general startup procedure is performed with quick-startup wizards. Up to two percentages can be displayed graphically or numerically. Contains de, en, fr, it and es language packages. Updatable and extendable via USB interface.

Order no. **8022476**



### Basic Operator Panel (BOP-2)

Operator panel with 2-line display and basic startup menu navigation. Two percentages can be numerically displayed at the same time for frequency converter diagnostics.

Order no. **8022475**



### 1 EMC motor cable

Pre-assembled cable, prepared to connect the asynchronous machine and frequency converter with one another with EMC compliance. The shielded cable has a system plug for connecting to the converter; on the motor side, it is equipped with a shielded terminal and individual 4 mm safety plugs. Set including shield connection adapter for motor. Length 2 m.

Order no. **8038849**

### 2 Set of feet and device handle

Using the frequency converter on the table-top is even more convenient with the optional conversion set. The set comprises 2 fixed and 2 fold-out device feet, a folding device handle and the required mounting material. Suitable for all EMC-compliant frequency converters.

Order no. **8036788**

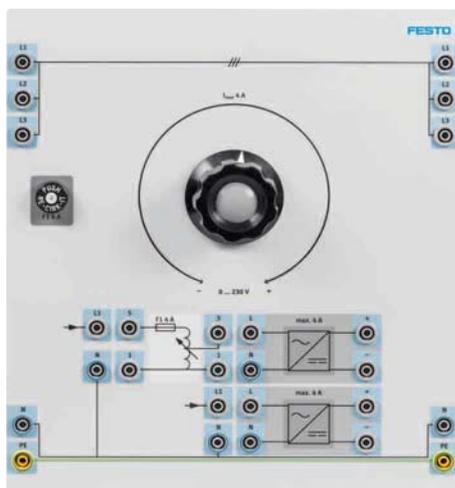
### 3 Startdrive software inclusive USB cable

Kit for parametrisation, startup, optimisation, diagnostics and control, consisting of software and USB cable (2 m).

Order no. **8022477**

# EduTrainer® regulating transformer

New



Single-phase regulating transformer for providing a variable alternating current.

Alternatively, the device can be used via the integrated rectifier as an unsmoothed direct current source with a variable and a fixed output, e.g. for supplying electrical machinery.

The integrated device circuit breaker deactivates the variable output voltage in the event of an overload or short circuit.

The locations of all connections are standardised and are routed to safety sockets or system plugs.

### Technical data

- Input voltage: 1 x 230 V AC
- Output voltage: 1 AC/0 – 230 V, short-circuit and overload protected
- Max. output current: 4 A
- Rectifier load capacity: 4 A
- Front panel 266 x 297 mm
- For use in an A4 frame
- Connection via 4 mm safety plugs
- Through-feed for 3 x 400 V AC

# EduTrainer® field rheostat

New



The field rheostat allows the field voltage of motors and generators to be reduced if a set direct voltage is used. By connecting a variable resistor upstream, an exciter field can be set.

The resistor is infinitely adjustable.

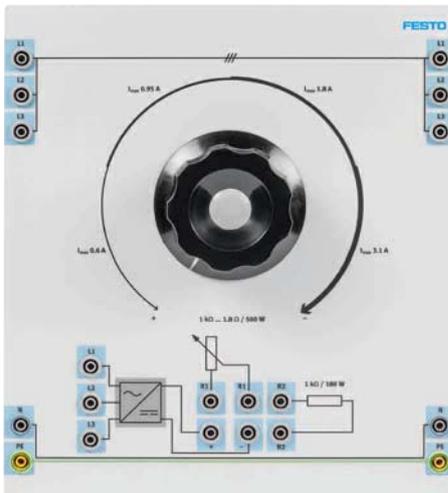
All connection locations are standardised and are laid out as safety sockets.

### Technical data

- Maximum input voltage: 230 V DC
- Maximum load capacity: 100 W
- Setting range 0 – 1.5 kΩ
- Maximum current: 0 – 450 Ω, 0.5 A
- 450 – 1.5k Ω, 0.25 A
- Front panel: 133 x 297 mm
- For use in an A4 frame
- Connection via 4 mm safety plugs
- Through-feed for 3 x 400 V AC

## EduTrainer® load resistance

New



The load resistance is used to load electrical machinery for use as generators or as starting resistors for slip ring rotors.

It consists of a rheostat with an upstream protecting resistor. An additional fixed resistor can extend the load range.

The rheostat is infinitely adjustable; the multi-level winding allows different maximum peak currents to be set as loads.

The 3-phase rectifier allows the load resistance to be used as a load for alternating and 3-phase current sources.

All connection locations are standardised and are laid out as safety sockets.

### Technical data

- Maximum input voltage: 230 V DC, 3x 400 V AC
- Load capacity: 500 W
- Setting range: 1.8 – 1 kΩ
- Maximum current:
  - 1.8 – 30 Ω, 3.1 A
  - 30 – 56 Ω, 1.8 A
  - 56 – 140 Ω, 0.95 A
  - 140 – 1 kΩ, 0.6 A
- Protecting resistance: 1.8 Ω
- Extension resistance: 1 kΩ/180 W
- Front panel: 266 x 297 mm
- For use in an A4 frame
- Connection via 4 mm safety plugs
- Through-feed for 3 x 400 V AC

## EduTrainer® plug sockets



The socket board provides three sockets with earthing contact and one CEE socket (16 A) for connection of single-phase or three-phase loads.

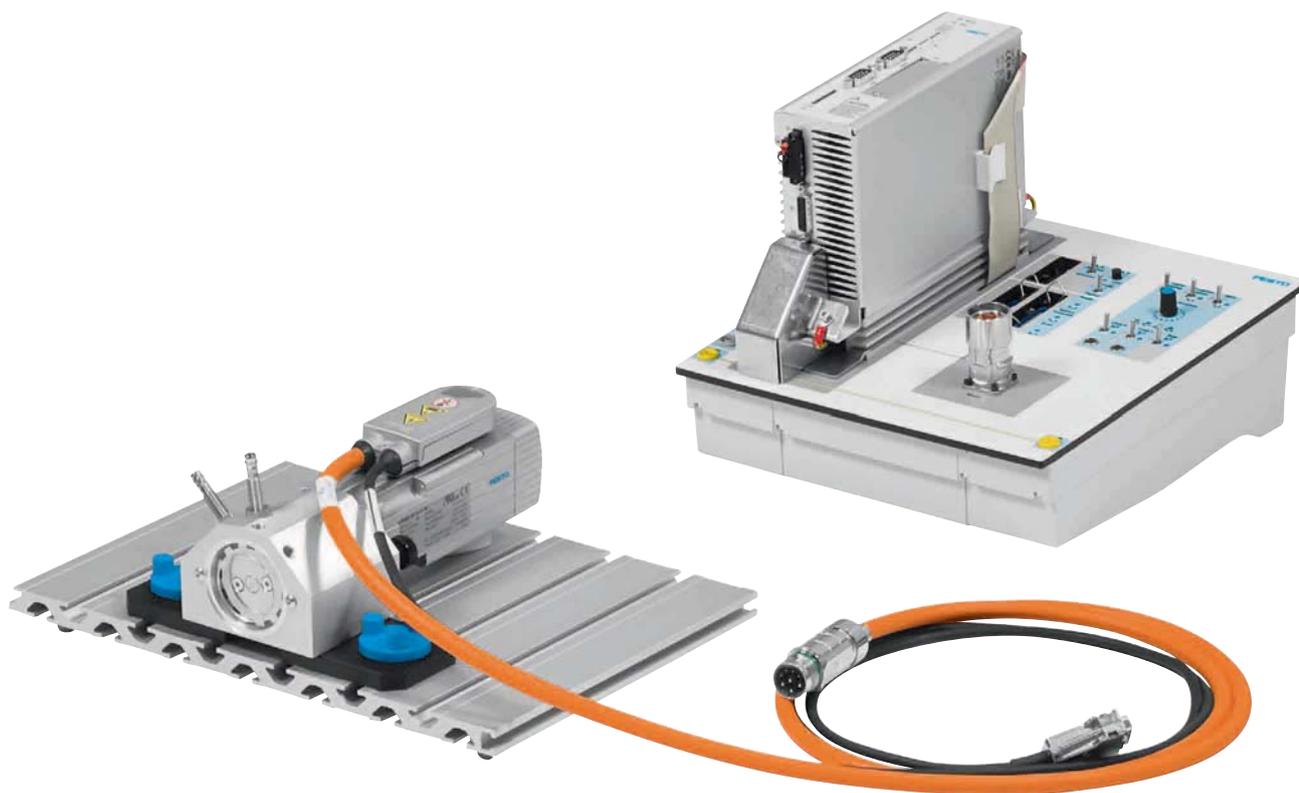
The locations of all connections are standardised and are routed to safety sockets or system plugs.

### Technical data

- Input voltage: 3 x 400 V AC
- Output voltage: 3 x 400 V AC
- Load rating: maximum 16 A
- Front panel: 133 x 297 mm
- Console housing with rubber feet for use in an A4 frame or on a table
- Connection via 4 mm safety plugs

# Equipment set TP 1421

## Servo motor drive technology



### Drives with servo motors

Modern servo drives have become indispensable for a wide variety of automation tasks thanks to their combination of high precision, dynamic response and torque. Basic knowledge of the areas of application and the components of modern servo drives is therefore essential.

The use of the latest generation of Festo controllers and motors guarantees that this equipment set is up-to-date, while the supplied PC software facilitates project engineering.

### Reliable and flexible

The rotary disk guarantees simple and reliable handling of the system throughout all stages of the introductory course. The integrated limit switches support the simulation of an axis on a range of rotation of approx. 340°. Metering can be implemented for extended training content.

### Advantages

- The latest generation of modern drive components from Festo
- Integrated SysLink interfaces
- Integrated test box for all important I/Os
- Standardised concept from basic principles to application
- The component set contains all of the components for carrying out basic experiments and provides clear assignment thanks to its printed storage panel.

### Training content

- Components of a drive system
- Design
- Commissioning
- RPM regulation
- Regulating torque
- Homing
- Positions
- Ramps

Complete equipment set TP 1421 **571849**

The most important components at a glance:

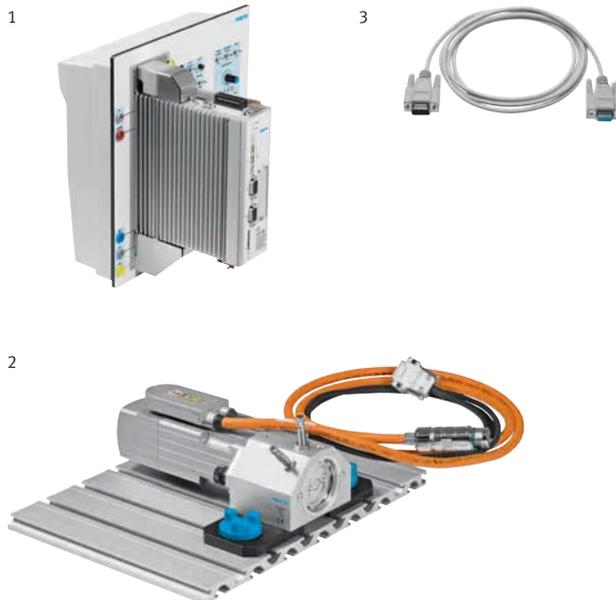
1	1x EduTrainer servo motor controller	On request
2	1x Servo motor drive unit	On request
3	1x Null modem cable	On request

Possibilities of expansion:

EGC linear axis 600 mm including mounting kit	571873
MPS Handling station, electrical	567203

Recommended accessories, also order:

RS232 USB adapter	540699
Electric drives 1: WBT → Page 22	
Electric drives 2: WBT → Page 22	



Also order:

**Workbook**

The basic principles of servo motor drive technology are explained using real project engineering.

Worksheets support the students through the required stages of introduction, planning and execution of exercises, evaluation of results and documentation.

Articular emphasis is placed on independent execution by the student.

The workbook contains:

- Solutions
- Didactic notes
- Multimedia CD-ROM with graphics
- Worksheets for the student

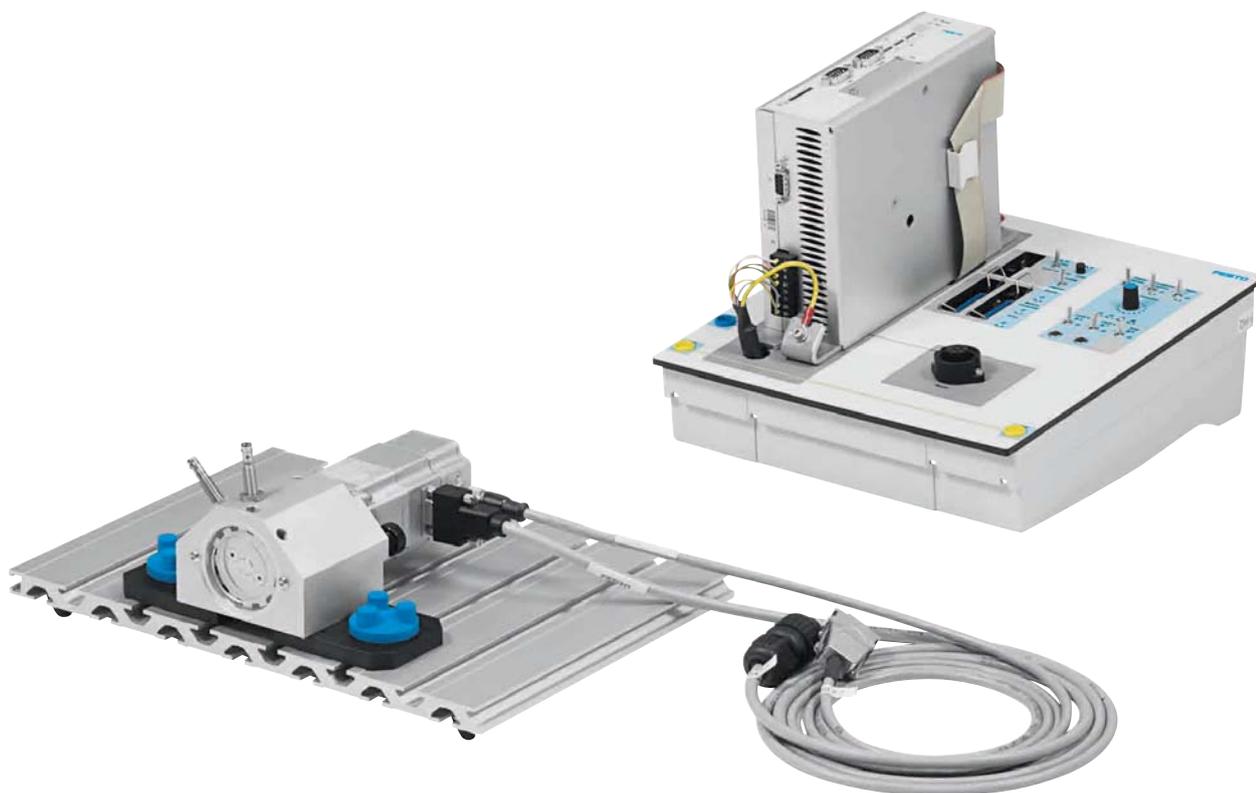
Campus licence (→ Page 53):

de	<b>571851</b>
en	<b>571853</b>
es	<b>571855</b>
fr	<b>571857</b>



# Equipment set TP 1422

## Stepper motor drive technology



### Drives with stepper motors

One of the main reasons why drive tasks are implemented with stepper motor drives in modern systems is the cost benefit. However, the weaknesses associated with their design mean that basic knowledge of the components and areas of application is essential.

The current components in the equipment set and the supplied PC software provide a useful introduction to this topic.

### Convenient and open

The integrated simulation box allows the connection of the required inputs and displays the states of all important outputs. This allows convenient operation without any additional hardware. The analogue and digital SysLink interfaces make it easy to integrate the drives in complete systems for explaining additional content.

### Advantages

- The latest generation of modern drive components from Festo
- Integrated SysLink interfaces
- Integrated test box for all important I/Os
- Standardised concept from basic principles to application
- The component set contains all of the components for carrying out basic experiments and provides clear assignment thanks to its printed storage panel.

### Training content

- Components of a drive system
- Design
- Commissioning
- RPM regulation
- Homing
- Positions
- Ramps

Complete equipment set TP 1422 **571850**

The most important components at a glance:

1	1x EduTrainer stepper motor controller	On request
2	1x Stepper motor drive unit	On request
3	1x Null modem cable	On request

Possibilities of expansion:

EGC linear axis 600 mm including mounting kit	571873
MPS Handling station, electrical	567203

Recommended accessories, also order:

RS232 USB adapter	540699
Electric drives 1: WBT → Page 22	
Electric drives 2: WBT → Page 22	



Also order:

### Workbook

The basic principles of stepper motor drive technology are explained using real project engineering.

Worksheets support the students through the required stages of introduction, planning and execution of exercises, evaluation of results and documentation.

Articular emphasis is placed on independent execution by the student.

The workbook contains:

- Solutions
- Didactic notes
- Multimedia CD-ROM with graphics
- Worksheets for the student

Campus licence (→ Page 53):

de	<b>571859</b>
en	<b>571861</b>
es	<b>571863</b>



## EGC linear axis 600 mm including mounting kit



Linear axis for work on additional teaching content together with the basic training packages for servo or stepper motor drive technology.

#### Advantages:

- The latest generation of modern drive components from Festo
- Built-in quick coupling for connection to basic training drive packages
- Complete with Quick-Fix holder for slotted assembly board
- Limit switches included in scope of delivery

#### Technical data

- 600 mm working stroke
- Maximum speed 3 m/s
- Maximum acceleration 50 m/s<sup>2</sup>
- Feed force maximum 50 N
- Dimensions: 600 x 60 x 50 mm (H x W x D)

## EduTrainer® supply unit



The supply unit ensures safe operation of single-phase servo controllers or frequency converters at workstations where there is no corresponding infrastructure. It is connected to the mains supply via a non-heating device cable and makes it possible to provide an electrically safe workstation even in places where there is no separate fuse protection or type B RCD protection available.

The unit offers the following functions:

- Short circuit protection
- RCD protection, type B
- Emergency stop for the workstation
- Safety when restarting after voltage recovery
- Switching the workstation power supply on and off

It also provides the 24 V DC voltage necessary for operation.

The locations of all connections are standardised and are laid out as safety sockets.

#### Technical data

- Supply voltage: 1 AC/230 V (50 Hz)
- Output voltage: 1 AC 230 V with type B RCD protection 30 mA, output current max. 6 A
- DC 24 V, 2 A
- Outputs are protected against short circuits and overload
- Front panel: 133 x 297 mm
- Console housing with rubber feet for use in an A4 frame or on a table
- Power supply via non-heating device connection
- Outputs for 4 mm safety plugs

## EduTrainer<sup>®</sup> motor switches



The motor switches are designed for direct switch activation of electric machines. Equipped with on/off switch, polarity reversal switch and star/delta switch.

The locations of all connections are standardised and are routed to safety sockets or system plugs.

### Technical data

- Input voltage: 3 x 400 V AC
- Output voltage: 3 x 400 V AC
- Load rating: maximum 16 A
- Front panel: 266 x 297 mm
- Console housing with rubber feet for use in an A4 frame or on a table
- Connection via 4 mm safety plugs

## EduTrainer<sup>®</sup> Dahlander switch

New



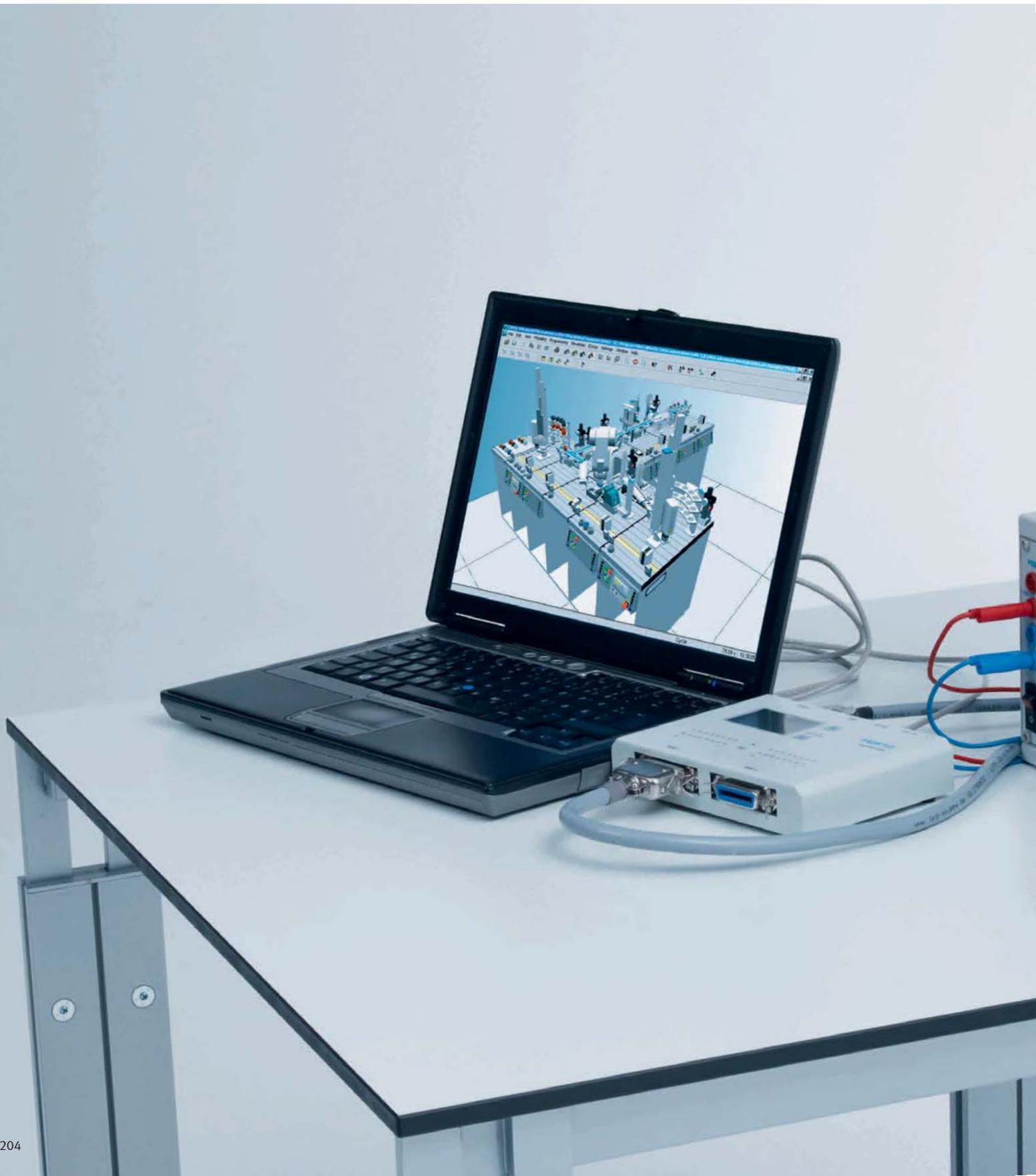
The motor switches are designed for direct switch activation of electric machines. Fitted with a Dahlander switch and switches for asynchronous motors with separate windings.

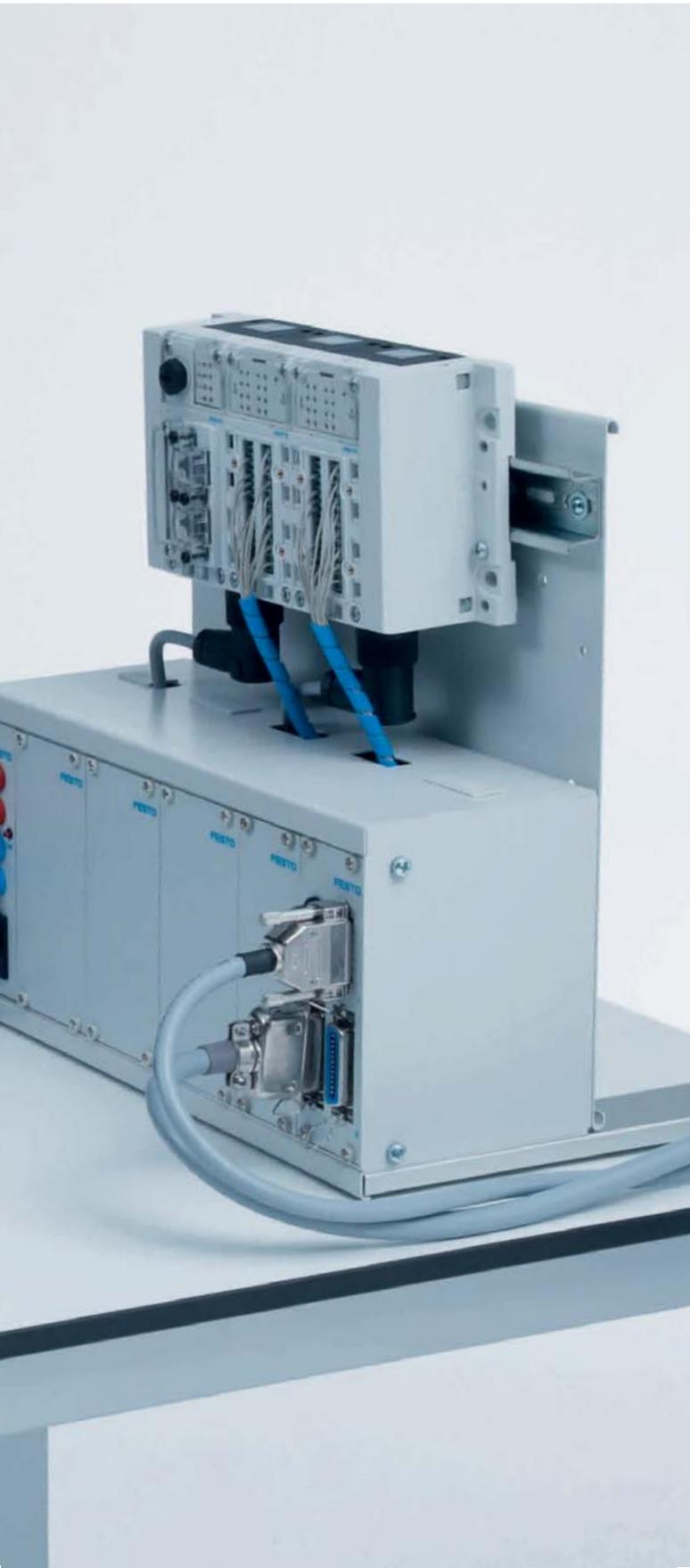
The locations of all connections are standardised and are routed to safety sockets or system plugs.

### Technical data

- Input voltage: 3x 400 V AC
- Output voltage: 3x 400 V AC
- Load rating: maximum 16 A
- Front panel: 266 x 297 mm
- Console housing with rubber feet for use in an A4 frame or on a table
- Connection via 4 mm safety plugs

## Automation technology/PLC training packages





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# Automation technology/PLC training packages

## From buttons to automation solutions



### Control system, Process, Didactics

Forward-looking training is ultimately all about reliable and efficient automation of production processes.

- Automation systems must correspond to those in future workplaces
- Processes must be as close as possible to those used in actual production
- The training content and methods must lead to expertise, which future specialist staff can use to secure their and their companies' future.



#### EduTrainer® Universal

- The universal holder system with control systems, power supply unit and simulations
- Alternative connections for 4 mm and SysLink
- In two lengths, as a table-top rack or A4 plate for A4 mounting frames
- Variable equipment including market leading control systems and 19" simulation plates

The online configurator provides support in selecting and combining the appropriate components.



#### EduTrainer® Compact

- The sturdy PLC for fluid engineering laboratories
- Suitable for the ER mounting frame
- With 4 mm connection technology and/or SysLink

The EduTrainer® Compact is the ideal control system for fluid engineering laboratories and has proven itself worldwide.



#### SCE Trainer Packages

As a certified Siemens Solution Partner Automation and Siemens SCE Partner we recommend the "First Choice" Siemens automation technology.

The SCE Trainer Packages offer crucial advantages for classroom equipment.



### From manual to machine

Clarity on the one hand, maximum industrial relevance and practical transfer on the other. The equipment and solutions for automation/PLC technology meet all requirements:

- from simple to complex models
- from manual control to relay
- from digital mini control system to PLC

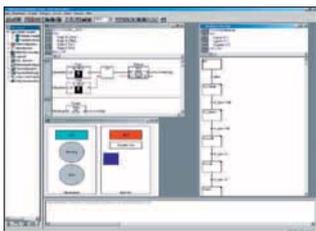
The balance is achieved because the learning system for automation technology is vertically and horizontally integrated.



### The process is the key

An ongoing production process cannot be taken "out of operation" for training purposes. Therefore, the key is to offer the right "artificial" training processes that are economical, flexible and practical.

- Virtual: CIROS®, FluidSIM® or EasyVeep offer hundreds of different processes for actuation via EasyPort or OPC.
- Actual: The best process environment is provided by the modular production system MPS®.



### Automation with CODESYS®

We recommend Codesys® as an IEC 61131-3 compatible programming system for the Festo CPX or CECC range of controllers.

- Flexible and open for all kinds of control tasks
- Very simple to commission and program
- Ethernet communication for simple programming with module library

Note: With an OPC interface, Codesys® is suitable for controlling the processes in CIROS® and thus for purely PC-based training in programming.

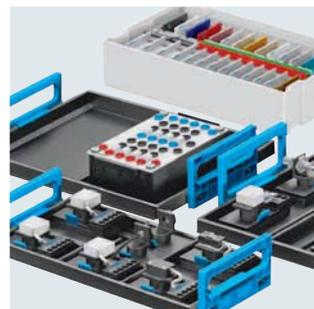


### Mini control system

#### Operation and monitoring

Electrical engineering laboratories are equipped with mounting frames and training devices in A4 format as standard. Training devices, e.g. with mini control system or touch panel supplement your electrical laboratory:

- Siemens LOGO!
- Eaton easyRelay
- Siemens TP700 und KTP700 – the touch panel for training and professional applications



### Equipment sets for your course

Having the correct and practically relevant automation equipment is important. However, it is the right concepts, processes and exercises that really give your equipment the critical added value. This is what our equipment sets and their course-documents provide:

- The TP 1311 clarifies the use of sensors in automation
- The TP 301 makes the leap from electropneumatics into PLC technology
- The TP 401 and 402 provide a practical introduction to the world of fieldbuses



### Terminal, 4 mm and SysLink

Requirements for connection technology can differ greatly. The Edu-Trainer® for PLC training meets all of them:

- 4 mm safety sockets are correct if the circuit diagram is to lead into the controller configuration
- SubD or Centronics for complex circuits or if the correct wiring is no longer the key focus

# EduTrainer® Universal

## For maximum flexibility



### The EduTrainer® Universal

Do you rely on a PLC from a global market leader? 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!

Whatever is particularly important to you: You can get exactly the EduTrainer® Universal that you need – so you can focus on what is important to you:

- Fully set up and configured or your own design
- With PLCs from Siemens, Festo and other leading manufacturers
- With or without power supply unit
- With or without 4 mm safety sockets
- And always with the standard SysLink interface



### Universal shape and size

The EduTrainer® Universal deserves its name:

- It fits in the A4 and ER mounting frames.
- However, it can also stand on a table or lie flat.
- It is available ready to use in every conceivable configuration – or you can set it up yourself.
- Narrow and wide designs are available – so that you only pay for what you need.

### Universal equipment

There are many more than just 5 or 6 leading manufacturers of programmable logic controllers worldwide. That is why we have prepared the EduTrainer® Universal for different H-rails so that it can be fitted with any PLC.

Below the PLC, the 19" plug-in format ensures that you can equip it with any conceivable combination of connecting plates and simulation modules.

### Online configurator for EduTrainer® Universal and Compact

Configuration made easy!

The EduTrainer® online configurator provides you with assistance when selecting components, in order to ensure that the mounting system and the PLC equipment will work well together. After configuration has been completed, you can view an illustration of your EduTrainer® Universal or Compact, and you have an order code for placing your order.

Trouble-free on the Internet:

- Select a mounting system (Universal A4, rack or Compact in various widths)
- Select controller manufacturer, controller range and controller type
- Select modules in addition to the controller if desired
- Select 19" simulation modules (digital, analogue or other)
- Select accessories
- Done – and you can request a quote from us for the desired configuration.

# EduTrainer® Universal

## Your advantages

### The holder system

#### Huge freedom: 305 or 458 mm

The powder-coated A4 steel plate of the holder system and the mounting frame for the 19" modules are either 305 mm or 458 mm wide. This means that the smaller EduTrainer® fits perfectly in the trolleys in the MPS® stations. And the size provides space for numerous expansions.

#### For ER and A4

The EduTrainer® Universal fits in any A4 mounting frame. It can also be hung in an ER mounting frame thanks to the appropriate hooks on the rear.

### Upright and horizontal

The handle on the rear allows the EduTrainer® to be taken anywhere. When working standing up, the EduTrainer® can be placed on its back. To allow this, care has been taken to make sure that the 120/230 Volt connection on the rear is not in the way.

### Rack version

If it is to be used upright on a table, we give it two feet and call it the EduTrainer® A4 Rack. The feet can easily be removed so that it fits in the mounting frame for the laboratory furniture.



### Control systems and PLC modules

This EduTrainer® is universal because it can be fitted with all industrial controllers from the market leaders:

- Siemens S7
- Siemens LOGO!
- Festo CECC
- Festo CPX
- Allen-Bradley
- Mitsubishi
- and more

Your preferred PLC not listed? No problem. You can fit your PLC yourself on the “blank” EduTrainer®.



### 19" simulation modules

#### Modules for all situations

Thanks to a wide variety of simulation modules, all of which can be ordered individually, a huge range of different processes can be connected and simulated during the training. The modules are compatible with any PLC and are easy to assemble.

Existing EduTrainer® Universal units can be expanded with these modules at any time.



# EduTrainer® Universal Preferred versions Laboratory

## A4 rack with SIMATIC S7-300 and 19" simulation modules



1

1 S7-314C-2PN/DP	8034580
2 S7-313C-2DP (458 mm)	567108
3 S7-314C-2DP (458 mm)	567109
4 S7-315F-2PN/DP (305 mm)	567110

#### Recommended accessories:

I/O data cable with SysLink connectors (IEEE 488), 2.5 m	34031
Analogue cable, parallel, 2 m	529141
Safety laboratory cable, 3 m	571817
PC adapter, USB	539006
Programming software STEP 7 → Page 46	
IEC power cable 90° → Page 239	

#### Other accessories:

Digital I/O module SM323 8I/8O	184550
Digital I/O module SM323 16I/16O	529142
Front-panel connector, Screwed contacts	184554
Front-panel connector, Screwed contacts	660560
Analogue I/O module S7-SM334-4E/2A	184804
AS-Interface master upgrade S7-300 CP 343-2 AS-i Master	533028
Trainer Package Internet link S7-300, CP343-1 Advanced	533027
Analogue cable, crossover, 2 m	533039

2



4



3



#### The industrial standard for the laboratory

The modular concept of the SIMATIC S7-300 offers professional PLC technology from the market leader, Siemens. With various CPUs, CPs and I/O modules, the S7-300 meets all automation requirements. This controller facilitates the use of a wide range of fieldbuses such as AS-interface, Profibus DP and Profinet.

The STEP 7 programming environment makes all industrially used PLC programming languages available, such as IL, LD, FBD, STEP 7-SCL, STEP 7-GRAPH and STEP 7-HiGraph.

#### EduTrainer® Universal with:

##### CPU 313C-2DP

- 128 KB RAM for program and data
- Includes MMC
- Interface: MPI, Profibus DP
- I/Os:
  - 16 digital inputs (24 V DC)
  - 16 digital outputs (24 V DC, 400 mA)
- SM 334:
  - 4 analogue inputs, 8 bit (0–10 V, 0–20 mA)
  - 2 analogue outputs (0–10 V, 0–20 mA)

##### CPU 314C-2DP

- 192 KB RAM for program and data
- Includes MMC
- Interfaces: MPI, Profibus DP
- I/Os:
  - 24 digital inputs (24 V DC)
  - 16 digital outputs (24 V DC, 400 mA)
  - 4 analogue inputs, 11 bit, 20 ms, (±10 V, 0–10 V, ±20 mA, 0/4–20 mA), 1 Pt100 input
  - 2 analogue outputs, (±10 V, 0–10 V, ±20 mA, 0/4–20 mA)

##### CPU 314C-2PN/DP

- 192 KB RAM for program and data
- Includes MMC
- Interfaces: MPI, Profibus DP, Profinet
- I/Os:
  - 24 digital inputs (24 V DC)
  - 16 digital outputs (24 V DC, 500 mA)
  - 4 analogue inputs, 12 bit, 20 ms, (±10 V, 0–10 V, ±20 mA, 0/4–20 mA), 1 Pt100 input
  - 2 analogue outputs, (±10 V, 0–10 V, ±20 mA, 0/4–20 mA)

##### CPU 315F-2PN/DP

- 512 KB RAM for program and data
- Includes MMC
- Interfaces: MPI, DP, PN
- SM 323:
  - 16 digital inputs (24 V DC)
  - 16 digital outputs (24 V DC, 500 mA)
- SM 334:
  - 4 analogue inputs, 8 bit (0–10 V, 0–20 mA)
  - 2 analogue outputs (0–10 V, 0–20 mA)

#### The holder system

- EduTrainer® A4 rack, desktop variant, size 1 or size 2, W x H 305/458 mm x 300 mm
- 19" module simulation plate with 2 x SysLink plug connector for MPS® station and control panel, each with 8 digital inputs and 8 digital outputs and 1 x Sub-D 15-pin plug connection with 4 analogue inputs and 2 analogue outputs; emergency stop jumper to connect a safety circuit for disconnecting 8 digital outputs.
- Integrated power supply unit 110/230 V/24 V, 4.5 A
- Stable, powder-coated, sheet-steel holder system
- 19" simulation modules: 16 DIN, 16 DOUT, 4 AIN/2 AOUT, SysLink

EduTrainer® Universal Preferred versions for MPS®/MPS® PA  
→ Pages 338 – 341

# EduTrainer® Universal Preferred versions Laboratory

## A4 rack with SIMATIC S7-1200 and 19" simulation modules

### The modular mini control system from Siemens

For solutions in discrete and stand-alone automation applications in the lower performance range.

The SIMATIC S7-1200 controller family has a, integrated engineering system: SIMATIC STEP 7 Basic for controllers and HMI

### EduTrainer® Universal with:

#### CPU S7-1214C

- 75 kByte main memory, 4 MByte program memory
- Interface: RJ45
- I/Os:
  - 14 digital inputs (24 V DC)
  - 10 digital outputs (24 V DC, 500 mA)
  - 2 analogue inputs, 10 bit (0 – 10 V)

#### CPU module:

#### Analogue output SB 1232 AQ

- AO 1 x 12 Bit ( $\pm$  10 V DC/0 – 20 mA)

### The holder system

- EduTrainer® Universal, size 1, W x H 305 mm x 300 mm
- 19" module simulation plate with 2 x SysLink plug connector for MPS® station and control panel, each with 8 digital inputs and 8 digital outputs and 1 x Sub-D 15-pin plug connection with 4 analogue inputs and 2 analogue outputs; emergency stop jumper to connect a safety circuit for disconnecting 8 digital outputs.
- Integrated 110/230 V/24 V, 4.5 A power supply unit (only with order no. 567240, 567242)
- Can be placed on a desk or in an MPS® station
- Stable, powder-coated, sheet-steel holder system
- Can be expanded with 19" simulation modules (only order no. 567242 and 567243)

Order no. 567240 and 567241 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), analogue processing 4 analogue inputs on 4 mm safety sockets can be switched to simulation via potentiometer and 2 analogue outputs on 4 mm safety sockets
- 19" module 24 V/0 V (9 TE), 8 x 4 mm safety sockets, red for 24 V distribution, 8 x 4 mm safety sockets, blue for 0 V distribution



1

1	6x S7-1200-TP (ON, SL)	567243
2	6x S7-1200-TP (SL)	567242
3	6x S7-1200-TP (ON)	567241
4	6x S7-1200-TP	567240

#### Notes

The EduTrainer® Universal S7-1200-TP is equipped with or without (ON) a power supply unit and also with either 19" simulation modules or with SysLink (SL) only. Includes programming cable and programming software.

The EduTrainer® is available in a six pack. It is based on the SCE trainer package S7-1200 → Page 224

#### Recommended accessories:

I/O data cable with SysLink connectors (IEEE 488), 2.5 m	34031
Analogue cable, parallel, 2 m	529141
Safety laboratory cable, 3 m	571817
IEC power cable 90° → Page 239	

#### Other accessories:

Trainer Packages SIMATIC Panels → Pages 226 – 227	
Analogue cable, crossover, 2 m	533039



2



4



3

EduTrainer® Universal Preferred versions for MPS®/MPS® PA  
→ Pages 338 – 341

Special licence rules apply for schools and educational institutes in the commercial sector.

# EduTrainer® Universal Preferred versions Laboratory

## A4/A4 rack with SIMATIC S7-1500 and 19” simulation modules

New



S7-1516F-3PN/DP

8034574

### Note

These EduTrainer® system is based on Siemens SCE Trainer Package S7-1516F-3PN/DP. When Siemens updates these Trainer Package, the controllers are replaced by the successor models. Subject to technical implementation.

### Recommended accessories:

I/O data cable with SysLink connectors (IEEE 488), 2.5 m	34031
Analogue cable, parallel, 2 m	529141
Safety laboratory cable, 3 m	571817
IEC power cable 90° → Page 239	
Programming software STEP 7 → Page 46	

### Other accessories:

Trainer Packages SIMATIC Panels → Pages 226 – 227	
Analogue cable, crossover, 2 m	533039

### 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 S7-1516F-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)
- 8 x analogue inputs, 8 x U/I/RTD/TC, 16-bit resolution
- 4 x analogue outputs, 4 x U/I, 16-bit resolution

### The mounting system

- EduTrainer® Universal, size 1 (W x H) 305 mm x 300 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, 4.5 A
- 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), analogue processing 4 analogue inputs on 4 mm safety sockets can be switched to simulation via potentiometer and 2 analogue outputs on 4 mm safety sockets
- 19” module 24 V/0 V (9 HP), 8 x 4 mm safety sockets, red for 24 V distribution, 8 x 4 mm safety sockets, blue for 0 V distribution
- 19” module simulation plate with 2 x SysLink plug connector for MPS® station and control panel, each with 8 digital inputs and 8 digital outputs and 1 x Sub-D 15-pin plug connector with 4 analogue inputs and 2 analogue outputs; emergency stop jumper to connect a safety circuit for disconnecting 8 digital outputs.

Special licence rules apply for schools and educational institutes in the commercial sector.

# EduTrainer® Universal Preferred versions Laboratory

## A4/A4 rack with Allen-Bradley CompactLogix and 19" simulation modules

New

### 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 CompactLogix

##### 1769-L24ER-QB1B

- Main memory: 0.75 MB
- 1 GB SD memory card included
- Interfaces: 2 x EtherNet/IP, 1 x USB
- Inputs/outputs:
  - 16 digital inputs (24 V DC)
  - 16 digital outputs (24 V DC/0.5 A)

#### AB CompactLogix

##### 1769-L24ER-QBFC1B

- Main memory: 0.75 MB
- 1 GB SD memory card included
- Interfaces: 2 x EtherNet/IP, 1 x USB
- Inputs/outputs:
  - 16 digital inputs (24 V DC)
  - 16 digital outputs (24 V DC)
  - 4 universal analogue inputs
  - 2 universal analogue outputs
  - 4 high-speed counters

### The mounting system

- EduTrainer® Universal, size 1 (W x H) 305 mm x 300 mm
- Can be placed on a desk or in an MPS® station
- Stable, powder-coated, sheet-steel mounting system
- Integrated power supply unit 110/230 V/24 V, 4.5 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), analogue processing 4 analogue inputs on 4 mm safety sockets can be switched to simulation via potentiometer and 2 analogue outputs on 4 mm safety sockets (not with order no. 8022737)
- 19" module 24 V/0 V (9 HP), 8 x 4 mm safety sockets, red for 24 V distribution, 8 x 4 mm safety sockets, blue for 0 V distribution
- 19" module simulation plate with 2 x SysLink plug connector for MPS® station and control panel, each with 8 digital inputs and 8 digital outputs and 1 x Sub-D 15-pin plug connector with 4 analogue inputs and 2 analogue outputs; emergency stop jumper to connect a safety circuit for disconnecting 8 digital outputs.



1

1 AB CompactLogix 1769-L24ER-QB1B (digital)	8022737
2 AB CompactLogix 1769-L24ER-QBFC1B (digital/analogue)	8022848

#### Recommended accessories:

I/O data cable with SysLink connectors (IEEE 488), 2.5 m	34031
Analogue cable, parallel, 2 m	529141
Safety laboratory cable, 3 m	571817
IEC power cable 90° → Page 239	
Programming software RSLogix → Page 47	

#### Other accessories:

Analogue cable, crossover, 2 m	533039
--------------------------------	--------



2

# EduTrainer® Compact

## Integration into the workstation systems Learnline and Learntop



The **EduTrainer® Compact** fits in the ER mounting frame of many laboratory systems, but can also be used as a tabletop device or be mounted on a slotted profile plate. 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 and potentiometers. With the universal I/O interface socket SysLink – the connection to all equipment sets from Festo Didactic.

In order to simplify selection, we have put together some preferred variants for your convenience, which are equipped with the most common components (see table). If you require individualised solutions which go beyond the preferred variants, you can put them together with the help of our online configurator.

### First-choice partner: Siemens – Festo

Benefit from the cooperation of two market leaders.

Siemens control systems and software are standard in all equipment sets of Festo Didactic. As a first-choice partner of “Siemens Automation Cooperates with Education” (SCE), Festo Didactic offers customised solutions for research, development and training facilities worldwide.

The SIMATIC S7-300 is a modular PLC system from Siemens for industrial use. The PLC has been integrated in the didactic environment of the Festo Didactic ER format and thus suits perfectly for the use in education and training.

Cooperates  
with Education

Automation

SIEMENS

### Preferred variants

Equipment	without analogue processing	with analogue processing
<b>with AS-Interface and Profibus-DP</b>	EduTrainer® Compact S7-313C-2DP (Order no. 573888)	
<b>with Profibus-DP</b>	EduTrainer® Compact S7-313C-2DP (Order no. 573881) EduTrainer® Compact CECC-LK (Order no. 577602) EduTrainer® Compact CECC-D (Order no. 8024002)	EduTrainer® Compact S7-313C-2DP (Order no. 573882) EduTrainer® Compact S7-314C-2DP (Order no. 573883) EduTrainer® Compact S7-314C-2PN/DP (Order no. 576626)
<b>without bus</b>	EduTrainer® Compact S7-312C (Order no. 573885) EduTrainer® Compact S7-313C (Order no. 573880) EduTrainer® Compact LOGO! 8 (Order no. 8041132)	EduTrainer® S7-313C (Order no. 573887) EduTrainer® S7-313C-A (Order no. 573886) EduTrainer® S7-1214C (Order no. 573891, sixpack) EduTrainer® S7-1214C SysLink (Order no. 573892, sixpack) EduTrainer® S7-1214C (Order no. 573901) EduTrainer® S7-1214C SysLink (Order no. 573902)

# EduTrainer® Compact Preferred version with LOGO! 8

New

## 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 TP

Basic module 12/24 RCE (V8) 8 DI/4 DO with:

- 19" module, 8 DI with switch/pushbutton
- 19" module, 24 V/0 V
- 19" module, 4 DOR

Extension module, 4 DI/4 DO with:

- 19" module, 4 DOR

The programming software LOGO! Soft Comfort V8 is included.

## 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 plug, SysLink system connector → Pages 219 – 220
- Suitable for ER mounting frame or freestanding on the table
- Lightweight injection moulded housing
- Expandable to some extent with 19" simulation modules
- The units are supplied fully assembled
- Other combinations are possible via the online configurator



6x EduTrainer Compact Preferred version with LOGO! 8

8041132

### Recommended accessories:

Ethernet cable, 2 m	567280
Tabletop power supply unit → Page 239	
Power supply unit for mounting frame → Page 239	
4 mm Safety laboratory cables → Page 247	

Special licence rules apply for schools and educational institutes in the commercial sector.

# EduTrainer® Compact preferred variants with SIMATIC S7-1200



1

1 S7-1214C (ER2/19\"DIO-A-SL)	573902
2 6x S7-1214C-TP (ER2/19\"DIO-A-SL)*	573892
3 S7-1214C (ER2/19\"DIO-A-24V/0V)	573901
4 6x S7-1214C-TP (ER2/19\"DIO-A-24V/0V)*	573891

#### \* Notes

The EduTrainer® Compact S7-1214C-TP is shipped with programming cable and STEP 7 Basic programming software.

The EduTrainer® is available as a sixpack under order numbers 573891 and 573892.

It is based on the SCE-trainer package S7-1200 → Page 224

#### Recommended accessories:

I/O data cable with SysLink connectors (IEEE 488), 2.5 m	34031
Analogue cable, parallel, 2 m	529141
Tabletop power supply unit → Page 239	
Power supply unit for mounting frame → Page 239	
4 mm Safety laboratory cables → Page 247	
Ethernet cable, 2 m	567280
Programming software STEP 7 → Page 46	



2

Sixpack



4

Sixpack



3

#### 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 S7-1214C

- 50 kB RAM, 2 MB loading buffer
- Interface: RJ45
- Inputs/outputs:
  - 14 digital inputs (24 V DC)
  - 10 digital outputs (24 V DC, 500 mA)
  - 2 analogue inputs, 10 bit (0 – 10 V)

##### CPU module:

##### SB 1232 AQ analogue output

- AO 1 x 12 Bit ( $\pm 10$  V DC, 0 – 20 mA)

#### The mounting system

- EduTrainer® Compact for ER mounting frame in three different sizes with height and depth of approx. 170 x 80 mm:
  - Width for size 1 (ER1): 242 mm
  - Width for size 2 (ER2): 364 mm
  - Width for size 3 (ER3): 486 mm
- 19" modules with 4 mm safety plug, SysLink system connector or 24 V/0 V → Pages 219 – 220
- Suitable for ER mounting frame or unfastened on the table
- Lightweight injection moulded housing
- The units are shipped fully assembled.
- S7-1200 individual components upon request
- Other combinations are possible via the online configurator.

#### Recommended training media

WBT PLC programming in accordance with IEC 61131 → Page 24



Special licence rules apply for schools and educational institutes in the commercial sector.

# EduTrainer® Compact preferred variants with SIMATIC S7-300

## SIMATIC S7 EduTrainer® Compact

The S7 EduTrainer® Compact is well equipped with the compact version of the S7-300 series. Integrated digital and analogue inputs and outputs, as well as controllers with Profibus-DP, are available. A wide variety of PLC programming languages such as AWL, KOP, FUP, STEP 7-SCL and STEP 7-GRAPH can be used thanks to the STEP 7 programming environment.

### EduTrainer® Compact with:

#### CPU 312C

- 64 kB RAM for programme and data
- Includes MMC
- Interface: MPI
- Inputs/outputs:
  - 10 digital inputs (24 V DC)
  - 6 digital outputs (24 V DC, 400 mA)

#### CPU 313C

- 128 kB RAM for programme and data
- Includes MMC
- Interface: MPI
- Inputs/outputs:
  - 24 digital inputs (24 V DC)
  - 16 digital outputs (24 V DC, 400 mA)

#### CPU 313C-2DP

- 128 kB RAM for programme and data
- Includes MMC
- Interface: MPI, Profibus-DP
- Inputs/outputs:
  - 16 digital inputs (24 V DC)
  - 16 digital outputs (24 V DC, 400 mA)
- SM 334 (analogue add-on):
  - 4 analogue inputs, 8 bit (0 to 10 V, 0 to 20 mA)
  - 2 analogue outputs (0 to 10 V, 0 to 20 mA)

#### CPU 314C-2DP

- 192 kB RAM for programme and data
- Includes MMC
- Interfaces: MPI, Profibus-DP
- Inputs/outputs:
  - 24 digital inputs (24 V DC)
  - 16 digital outputs (24 V DC, 400 mA)
  - 4 analogue inputs, 11 bit, 20 ms ( $\pm 10$  V, 0 to 10 V,  $\pm 20$  mA, 0/4 to 20 mA), 1 Pt100 input
  - 2 analogue outputs ( $\pm 10$  V, 0 to 10 V,  $\pm 20$  mA, 0/4 to 20 mA)

#### CPU 314C-2PN/DP

- 192 kB RAM for programme and data
- Includes MMC
- Interfaces: MPI, Profibus-DP, ProfiNet
- Inputs/outputs:
  - 24 digital inputs (24 V DC)
  - 16 digital outputs (24 V DC, 500 mA)
  - 4 analogue inputs, 12 bit, 20 ms, ( $\pm 10$  V, 0 to 10 V,  $\pm 20$  mA, 0/4 to 20 mA), 1 Pt100 input
  - 2 analogue outputs ( $\pm 10$  V, 0 to 10 V,  $\pm 20$  mA, 0/4 to 20 mA)

### The mounting system

- EduTrainer® Compact for ER mounting frame in three different sizes with height and depth of approx. 170 x 80 mm:
  - Width for size 1 (ER1): 242 mm
  - Width for size 2 (ER2): 364 mm
  - Width for size 3 (ER3): 486 mm
- 19" modules with 4 mm safety plug, SysLink or AS-Interface system connector
  - Pages 219 – 220
- Suitable for ER mounting frame or unfastened on the table
- Lightweight injection moulded housing
- Expandable to some extent with 19" simulation modules
- Data buffering for S7-300 with micro memory card (included in scope of delivery)
- The units are shipped fully assembled.
- S7-300 individual components upon request
- Other combinations are possible via the online configurator.

### Recommended training media

WBT PLC programming in accordance with IEC 61131 → Page 24



7 (2/3/5/8)

1	S7-312C (ER2/19"DIO-SL)	573885
2	S7-313C (ER1/19"SL)	573880
3	S7-313C-2DP (ER1/19"SL)	573881
4	S7-313C (ER2/19"DIO-SL)	573887
5	S7-314C-2PN/DP (ER1/19"SL)	576626
6	S7-313C-A (ER2/19"DIO-SL)	573886
7	S7-313C-2DP-A (ER1/19"SL)	573882
8	S7-314C-2DP (ER1/19"SL)	573883
9	S7-313C-2DP (ER2/19"ASI-SL)	573888

### Recommended accessories:

I/O data cable with SysLink connectors (IEEE 488), 2.5 m	34031
Analogue cable, parallel, 2 m	529141
Tabletop power supply unit → Page 239	
Power supply unit for mounting frame → Page 239	
4 mm Safety laboratory cables → Page 247	
PC adapter, USB	539006
Programming software STEP 7 → Page 46	



# EduTrainer® Compact Preferred versions with Festo CECC

New



1

1 CECC-LK	577602
2 CECC-D	8024002

#### Note

The free Codesys® programming software is available for download on the Festo homepage.

#### Recommended accessories:

Tabletop power supply unit → Page 239
Power supply unit for mounting frame → Page 239
4 mm Safety laboratory cables → Page 247



2

#### 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:

- 4 x IO-Link Master
- 1 x IO-Link Device
- Ethernet connection
- USB connection
- CANopen

##### Festo CECC-D

Festo CECC-D EduTrainer® Compact, like CECC-LK, but without IO-Link.



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 parameterisation 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 plug
- Suitable for ER mounting frame or freestanding on the table
- Lightweight injection moulded housing
- The unit is supplied fully assembled
- Other combinations are possible via the online configurator

#### Recommended training media

WBT PLC programming in accordance with IEC 61131 → Page 24



# 19" simulation modules

## 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)

– Analogue value processing 4 analogue inputs on 4 mm safety socket switchable to simulation via potentiometer and 2 analogue 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 analogue inputs at 4 mm safety sockets

– 2 analogue 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 ASI (6 HP)

– Two 2-pin M12 sockets for pre-assembled AS-interface cables

– Integrated AS-interface filter for 24 V DC

Order no. **567115**

## 12 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 analogue outputs and 2 analogue inputs

– Emergency stop jumper for 8 digital outputs

Order no. **567122**

1



7



2



8



3



9



4



10



5



11



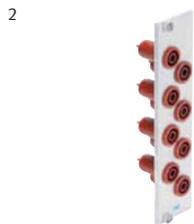
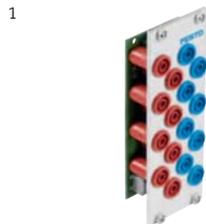
6



12



# 19" simulation modules



## 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" module 0V (6 HP)

- 8x 0 V on 4 mm safety sockets, blue.

Order no. **567121**

## 4 19" blanking plate

42 HP	<b>8022733</b>
32 HP	<b>195765</b>
18 HP	<b>8022732</b>
16 HP	<b>534630</b>
12 HP	<b>567123</b>
9 HP	<b>567124</b>
6 HP	<b>567125</b>
3 HP	<b>567126</b>

## 5 16-pin flat cable

16-pin flat cable, open at one end to connect 19" modules with analogue connection to any PLC with screw or CageClamp contacts, 500 mm long.

Order no. **567196**

## 6 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**

# EduTrainer® for mini control systems

New

## 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.

Now also with the new LOGO! 8.  
Ask your contact at Festo Didactic for your configuration.



Mini control systems are characterised 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.

The function range can be extended with numerous extension modules.

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! or the Eaton Easy family.

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 latch/pushbutton. 8 of the up to 12 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 unit or network switch.

The board can be with or without a power supply unit, with KNX interfaces or AS-Interface.

Please request a quotation for your individual requirements.

## Touch Panel TP700 EduTrainer®



Training device for the A4 mounting frame. The communication connections for

- 1 x PROFIBUS
- 2 x PROFINET
- 2 x USB

are accessible on the front side through sturdy plug connectors.

The touch panel TP700 Comfort is a 7" touch panel and comes from the Siemens HMI series for advanced applications. The features of the Comfort Panel include:

- Widescreen displays with 16 million colours and LED backlighting
- Comprehensive high-end functionality: archive, VB scripts and various viewers for displaying system documentation (e.g. as PDF) or in the form of Internet pages
- Data security in the event of a power failure
- Multiple interfaces for process communication
- Integrated PROFINET switch from 7"
- Programming from WinCC Comfort V11 (TIA portal)

Comprising:

- Siemens touch panel TP700 Comfort informatively arranged in an A4 board
- Ethernet cable (CAT 6, crossed, 6 m)
- Engineering, options and runtime software and licence for WinCC Advanced (TIA portal)

For schools and training centres in the commercial sector.

### System requirements

- 64 Bit: Windows 7 Professional, Enterprise, Ultimate SP1, Windows 8.1 Professional, Enterprise
- 32 Bit: Windows 7 Professional, Enterprise, Ultimate SP1

### Technical data

- Front panel: 266 x 297 mm
- Device depth: 90 mm
- Supply voltage: 24 V DC

Touch Panel TP700

8022729

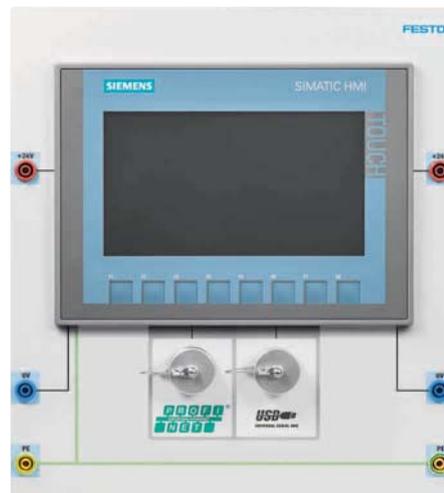
Recommended accessories:

4 mm Safety laboratory cables → Page 247

Tabletop power supply unit → Page 239

## Touch Panel KTP700 EduTrainer®

New



Training device for the A4 mounting frame. The communication connections for

- 1x PROFINET
  - 1x USB
- are accessible on the front side through sturdy plug connectors.

The Touch Panel KTP700 Basic PN is a 7" touch panel with 8 additional programmable function buttons which is part of the new basic Siemens HMI series for simple applications.

The characteristics of the basic panels are as follows:

- High-resolution dimmable widescreen displays with 64,000 colours
- Touch and button function
- Interface for connecting to various PLCs
- Archival via USB stick
- Programming from WinCC Basic V13 (TIA-Portal)

Comprising:

- Siemens KTP700 Basic PN Touch Panel with class preparation on an A4 board
- Siemens Ethernet Switch Scalence XB005
- 2x Ethernet cable (CAT 6, crossed, 6 m)

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

Touch Panel 1x KTP700 EduTrainer

8022731

Touch Panel 6x KTP700 EduTrainer

8041505

### Note

This package does not include any programming software. The programming software is included in Trainer Package SIMATIC S7-1200 DC/DC/DC or the EduTrainers with SIMATIC S7-1200, which are mentioned in the recommended accessories, or can be ordered separately.

Recommended accessories:

Trainer Package SIMATIC S7-1200 DC/DC/DC 567238

6x S7-1214C-TP (ER2/19"DIO-A-SL) 573892

6x S7-1214C-TP (ER2/19"DIO-A-24V/OV) 573891

4 mm Safety laboratory cables → Page 247

Tabletop power supply unit → Page 239

## 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 visualisation program via the PC interface. The visualisation 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!

Order no. **8024001**

Recommended accessories:  
IEC power cable → Page 239

## FED-CEC touch panel CODESYS®



Touch screen for flexibly displaying processes and data with integrated Codesys® PLC for open and closed-loop control of processes in accordance with IEC 61131. 8 digital inputs and 8 digital outputs can be used via SysLink. The Sub-D 15-pin connection is designed for 4 analogue inputs and 2 analogue outputs. 4 mm safety sockets are available for emergency stop and external power supply.

### Scope of delivery

- Festo 5.6" 256 colour FED-550 display, 32 MB internal RAM
- Programming software FED 2Designer (multilingual)
- RS232 programming cable for loading projects
- Angled plate for mounting onto a slotted profile plate
- Codesys® programming software provided by Festo

### Technical data

- FED-CEC with FED-UIM
- 32 bit MIPS RISC processor, 1 MB data memory, 350 us/K scan time
- Ethernet 10 Base-T, CANopen, Codesys®
- Integrated diagnostics for hardware detection
- Dimensions (W x H x D): 187 x 147 x 90 mm
- 20 inputs, digital 24 V DC
- 12 outputs, digital 24 V DC/0.5 A
- 8/4 analogue inputs, 12 bit, voltage/current/Pt100
- 4 analogue outputs, 12 bit, voltage or current (software selectable)

Order no. **567276**

### Recommended accessories:

I/O data cable with SysLink connectors (IEEE 488) at both ends, 2.5 m	34031
Analogue cable, parallel, 2 m	529141
Analogue cable, crossover, 2 m	533039
4 mm Safety laboratory cables → Page 247	
Tabletop power supply unit → Page 239	

## 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 parameterisation 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.

Festo CECC-LK → see figure!	<b>8023951</b>
Festo CECC-D	<b>8023952</b>

Recommended accessories:

I/O data cable with one SysLink connector as per IEEE 488 ...	
... and bare cable-end sleeves, 2.5 m	167122
Tabletop power supply unit → Page 239	

In addition, there is a wide variety of interfaces available as standard features on board:

- 4× IO-Link master
- 1× 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.
- Communication: ProfiNet, Ethernet IP and Modbus TCP are easy to integrate in higher-order systems.

**Festo CECC-D**, like CECC-LK, but without IO link.

## Siemens Trainer Packages



Sixpack



Sixpack

### **Trainer Package LOGO! 8**

With LOGO! 8, the successful Siemens logic module enters the next generation.

- Display with new look and feel
- Ethernet communication
- Integrated web server
- New software in new design

Comprising:

- 6x LOGO! 12/24 RCE (V8) with 8 digital inputs and 4 digital outputs
- 6x extension modules with 4 additional digital inputs and 4 digital outputs
- 6 copies of programming software LOGO! Soft Comfort V8

Order no. **8040049**

### **Trainer Package SIMATIC S7-1200 DC/DC/DC**

- Comprising:
- 6x SIMATIC S7-1200, CPU 1214C, COMPACT CPU, DC/DC/DC, ON-BOARD I/O: 14 DI 24 V DC; 10 DO 24 V DC; 2 AI 0 – 10 V DC. Power supply: 20.4 – 28.8 V DC, program/data memory: 75 KB
  - 6x SIMATIC S7, STEP 7 Basic (TIA-Portal), single licence, SW and documentation on DVD, licence key on USB stick, 2 languages (de/en)
  - 6x SIMATIC NET, Ind. Ethernet TP XP CORD RJ45/RJ45, CAT 6, crossed TP cable 4x2, with 2 RJ45 plugs, length 6 m
  - 6x SIMATIC S7-1200, simulator module
  - 6x SIMATIC S7-1200, analogue output, SB 1232, 1 AO, ±10 V DC or 0 – 20 mA

Order no. **567238**

# Siemens Trainer Packages



## Trainer Package

### SIMATIC S7-314C-2PN/DP

Comprising:

- CPU 314C-2PN/DP: compact CPU with MPI, 24 DI / 16 DO, 4 AI, 2 AO, 1 PT100, 4 fast counters (60 kHz)
- Integrated PN/DP interface
- RAM: 192 kB
- PS 307 power supply: 120/230 V AC or 24 V DC, 5 A
- 2x 40-pin front plug
- SM 374 simulator module, 16 inputs/outputs or 8 inputs/outputs, 16 switches, 16 LEDs
- Mounting rail, L = 480 mm
- Micro memory card: 512 kB
- PC adapter for USB connection to S7-200/300/400, C7; with USB cable (5 m)

Order no. **576299**

**New**

## Trainer package

### SIMATIC S7-1513-1PN

Comprising:

- CPU 1513-1PN, core assembly with 300 KB main memory for the program and 1.5 MB for data, ProfiNet IRT interface with 2 port switch, 40 ns bit performance
- SIMATIC PM 1507 24 V/8 A, regulated power supply for SIMATIC S7-1500, input: AC 120/230 V, output: DC 24 V/8 A
- Digital input module DI 32 x DC 24 V, 32 channels in groups of 16, input delay 0.05 – 20 ms, input type 3 (ICE 61131), diagnostics, process alarms
- Digital output module DQ 32 x DC 24 V/0.5 A; 32 channels in groups of 8, 4 A per group, diagnostics, replacement value
- SIMATIC S7-1500 profile rail 482 mm, including earthing screw, integrated DIN rail
- 2 x front panel connectors, screw terminal technology, 40-pin, for 35 mm wide assemblies, including 4 jumper links and cable ties
- Memory card 24 MB
- CAT 6 Ethernet cable, length 6 m

Order no. **8034570**

**New**

## Trainer package

### SIMATIC S7-1516F-3PN/DP

Comprising:

- CPU 1516F-3PN/DP, core assembly with 1.5 MB main memory for the program and 5 MB for data, 1st interface: ProfiNet IRT with 2 port switch, 2nd interface: Ethernet, 3rd interface: Profibus, 10 ns bit performance
- SIMATIC PM 1507 24 V/8 A, regulated power supply for SIMATIC S7-1500, input: AC 120/230 V, output: DC 24 V/8 A
- Digital input module DI 32 x DC 24 V, 32 channels in groups of 16, input delay 0.05 – 20 ms, input type 3 (ICE 61131), diagnostics, process alarms
- Digital output module DQ 32 x DC 24 V/0.5 A; 32 channels in groups of 8, 4 A per group, diagnostics, replacement value
- Analogue input module AI 8 x U/I/RTD/TC, 16 bit resolution, 8 channels in groups of 8
- Analogue output module AQ 4 x U/I/ST, 16 bit resolution, 4 channels in groups of 4
- SIMATIC S7-1500 profile rail 482 mm, including earthing screw, integrated DIN rail
- 4 x front panel connectors, screw terminal technology, 40-pin, for 35 mm wide assemblies, including 4 jumper links and cable ties
- Memory card 24 MB
- CAT 6 Ethernet cable, length 6 m

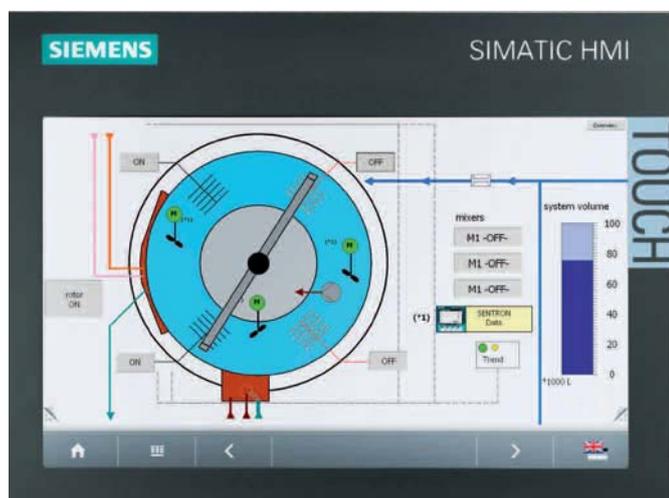
Order no. **8034571**

As a result of continuous development and research work technical specifications and illustrations are subject to change. They are not binding. The specified data serves purely as a product description and is no guarantee in a legal sense.

Special licence rules apply for schools and educational institutes in the commercial sector.

# Siemens Trainer Packages

Special licence rules apply for schools and educational institutes in the commercial sector.



## Trainer package

### SIMATIC Comfort Panel TP700

The TP700 Comfort Touch Panel is a 7" touch panel and comes from the Siemens HMI series for advanced applications.

The characteristics of the comfort panels are as follows:

- Widescreen displays with 16 million colours and LED backlighting
- Comprehensive high-end functionality: archive, VB scripts and various viewers for displaying system documentation (e.g. as PDF) or in the form of websites
- Data security in the event of a power failure
- Multiple interfaces for process communication
- Integrated PROFINET switch from 7"
- Programming from WinCC Comfort V11 (TIA portal)

#### Process interfacing:

- S7-1200, S7-1500
- S7-200, S7-300/400
- LOGO!
- WinAC
- Allen Bradley (EtherNet/IP), (DF1)
- Mitsubishi (MC TCP/IP), (FX)
- OMRON (Host Link)
- Modicon (Modbus TCP/IP), (Modbus RTU)
- OPC UA client

#### Comprising:

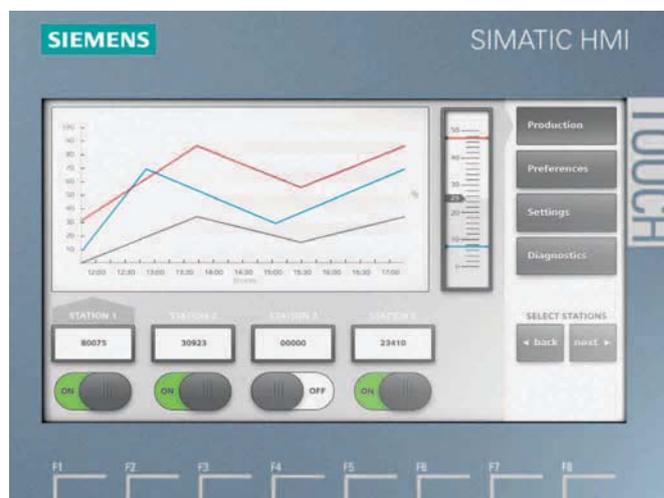
- Siemens TP700 Comfort Touch Panel
- Ethernet cable (CAT 6, crossed, 6 m)
- Engineering, options and runtime software and licence for WinCC Advanced (TIA portal)

#### System requirements

- 64 bit: Windows 7, Windows 8
- 32 bit: Windows 7

#### Technical data

- 7.0" widescreen TFT display (resolution: 800 x 480, 16 million colours)
- Touch screen
- 2 Ethernet interfaces
- 1 Profibus interface
- 2 USB interfaces with integrated switch
- Dimensions (W x H x D): 214 x 158 x 70 mm
- Supply voltage: 24 V DC



## New

### Trainer package

#### SIMATIC Basic Panel KTP700

The KTP700 Basic PN Touch Panel is a 7" touch panel with additional buttons which is part of the new basic Siemens HMI series for simple applications. The basic panels are ideal HMI components for small to mid-sized S7 control systems.

The characteristics of the basic panels are as follows:

- High-resolution dimmable widescreen displays with 64,000 colours
- Touch and button function
- Interface for connecting to various PLCs
- Archival via USB stick
- Programming from WinCC Basic V13 (TIA-Portal)

#### Process coupling:

- S7-1200, S7-1500
- S7-200, S7-300/400
- LOGO!
- WinAC
- Allen Bradley (EtherNet/IP)
- Mitsubishi (MC TCP/IP)
- Modicon (Modbus TCP/IP)

#### Comprising:

- Siemens KTP700 Basic PN Touch Panel
- Siemens Ethernet Switch Scalance XB005
- 2x Ethernet cable (CAT 6, crossed, 6 m)

#### System requirements

- 64 bit: Windows 7, Windows 8 SP1
- 32 bit: Windows 7

#### Technical data

- KTP700 Basic PN Touch Panel:
- 7" TFT display (resolution: 800 x 480, 64,000 colours)
- Touch screen with 8 programmable tactile function keys
- 1 Ethernet interface
- 1 USB interface
- Dimensions (W x H x D): 214 x 158 x 45 mm
- Supply voltage: 24 V DC
- Ethernet Switch Scalance XB005:
- For S7 and/or LOGO! and up to four other participants in industrial Ethernet
- 10/100 Mbit/s unmanaged switch
- 5 RJ45 ports
- LED diagnostics
- Supply voltage: 24 V DC

Trainer Package 1x SIMATIC KTP700	8040055
Trainer Package 6x SIMATIC KTP700	8040056

#### Note:

This package does not include any programming software. The programming software is included in Trainer Package SIMATIC S7-1200 DC/DC/DC (order no. 567238) or can be ordered separately.

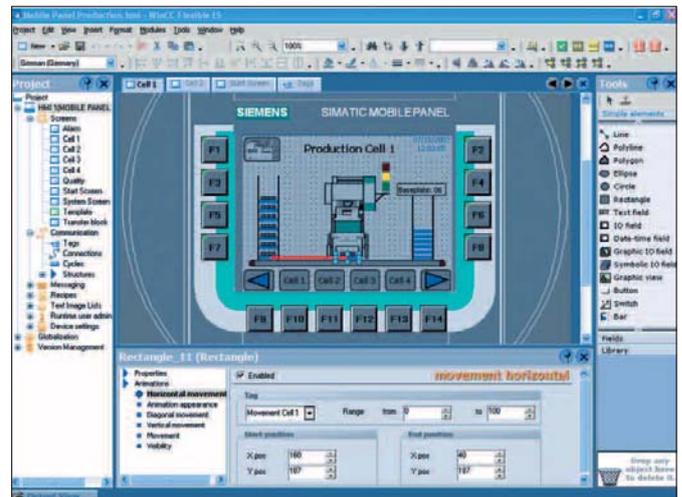
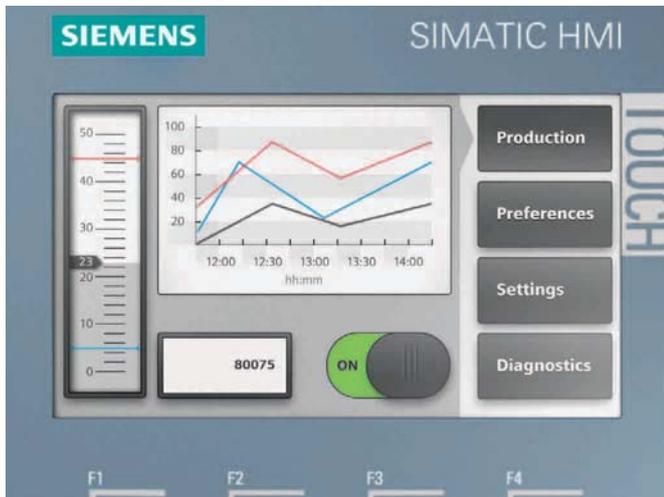
#### Recommended accessories:

Trainer Package SIMATIC S7-1200 DC/DC/DC	567238
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Order no.	8024273
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Special licence rules apply for schools and educational institutes in the commercial sector.

# Siemens Trainer Packages



New

## Trainer package SIMATIC Basic Panel KTP400

The KTP400 Basic PN Touch Panel is a 4.3" touch panel with additional buttons which is part of the new basic Siemens HMI series for simple applications. The basic panels are ideal HMI components for small to mid-sized S7 control systems.

The characteristics of the basic panels are as follows:

- High-resolution dimmable wide-screen displays with 64,000 colours
- Touch and button function
- Interface for connecting to various PLCs
- Archival via USB stick
- Programming from WinCC Basic V13 (TIA-Portal)

Process coupling:

- S7-1200, S7-1500
- S7-200, S7-300/400
- LOGO!
- WinAC
- Allen Bradley (EtherNet/IP)
- Mitsubishi (MC TCP/IP)
- Modicon (Modbus TCP/IP)

Comprising:

- Siemens KTP400 Basic PN Touch Panel
- Siemens Ethernet Switch Scalance XB005
- 2x Ethernet cable (CAT 6, crossed, 6 m)
- WinCC Basic programming software (TIA Portal)

**System requirements**

- 64 bit: Windows 7, Windows 8 SP1
- 32 bit: Windows 7

**Technical data**

- KTP400 Basic PN Touch Panel:
- 4.3" TFT display (resolution: 480 x 272, 64,000 colours)
  - Touch screen with 4 programmable tactile function keys
  - 1 Ethernet interface
  - 1 USB interface
  - Dimensions (H x W x D): 141 x 116 x 41 mm
  - Supply voltage: 24 V DC
- Ethernet Switch Scalance XB005:
- For S7 and/or LOGO! and up to four other participants in industrial Ethernet
  - 10/100 Mbit/s unmanaged switch
  - 5 RJ45 ports
  - LED diagnostics
  - Supply voltage: 24 V DC

## Trainer Package WinCC flexible/WinCC Advanced

Consistent family of engineering tools for project planning of SIMATIC HMI operator units and the PC-based visualisation systems WinCC Runtime Advanced and WinCC Runtime Professional.

Comprising:

- 6x combined licence for switchable use of SIMATIC WinCC flexible 2008 (Classic) and SIMATIC WinCC Advanced (TIA Portal)
- 6x option and run-time software
- 2x 20 SIMATIC WinCC Advanced/WinCC flexible 2008 SP3 for students (temporary with authorisation for 365 days)

## System requirements

- SIMATIC WinCC flexible 2008: Windows 7 Professional, Enterprise (not N), Ultimate SP1
- SIMATIC WinCC advanced: Windows 7 Professional, Enterprise (not N), Ultimate SP1/Windows 8.1 Professional, Enterprise

Authorisation on USB stick

Trainer Package 1x SIMATIC KTP400	8040053
Trainer Package 6x SIMATIC KTP400	8040054

Order no.	556239
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# Equipment set TP 1311

## Sensors for object detection



### 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

566918

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, receiver	548647
6	1x One-way light barrier, transmitter	548648
7	1x Fibre-optic unit	548655
8	1x Fibre-optic cable	548659
9	1x Retro-reflective sensor	548649
10	1x Reflector (triple mirror), 20 mm	548650
11	1x Diffuse sensor with background suppression	548656
12	1x Proximity sensor, capacitive, M12	548651
13	1x Indicator unit and distributor, electrical	162244
14	1x Slide unit	572740
15	1x Set of test objects	549830

Accessories, also order:

Aluminium profile plate → Page 238

Slotted mounting plate → Page 238

Tabletop power supply unit → Page 239

Power supply unit for mounting frame → Page 239

4 mm Safety laboratory cables → Page 247

Also order:

## Workbook



are covered by exercises using magnetic, inductive, optical and capacitive proximity sensors.

The workbook includes:

- Sample solutions
- Training notes
- Multimedia CD-ROM with graphics, photos of industrial applications
- Exercise sheets for trainees

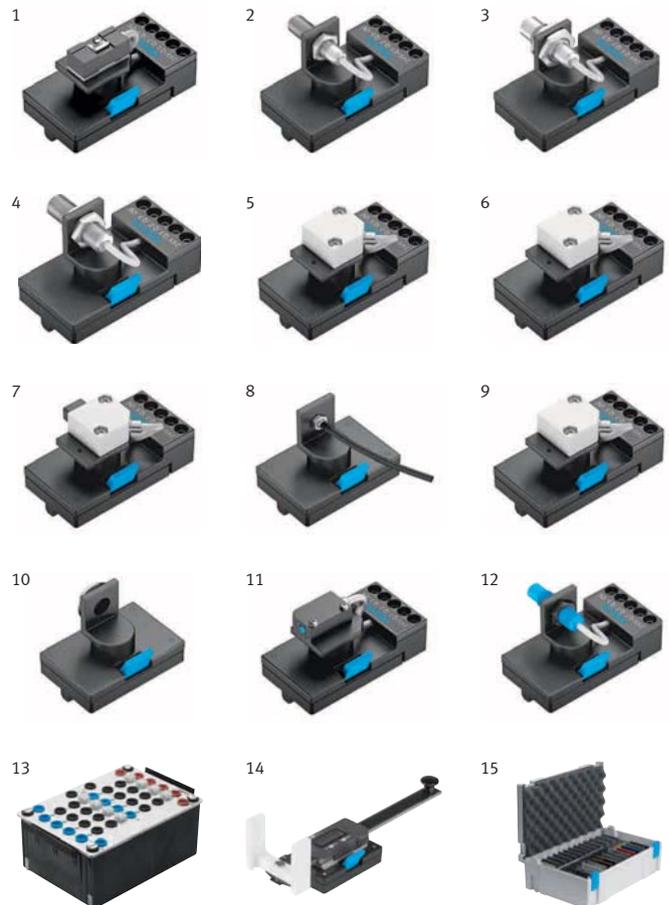
Campus licence (→ Page 53):

de	566919
en	566920
es	566921
fr	566922

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 topics

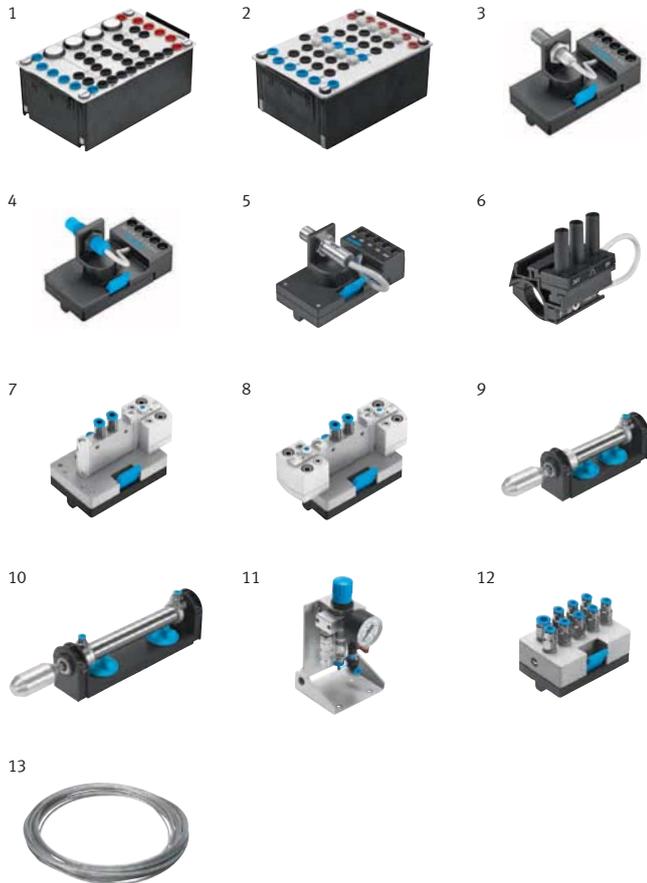
## Supplementary media

- WBT Sensor technology 2: Sensors for object detection
- Textbook: Proximity switches



# Equipment set TP 301

## Programmable logic controllers



### 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, 4 x 0.75 silver 10 m	151496

Recommended accessories:

Aluminium profile plate → Page 238	
Universal connection unit, digital (SysLink)	162231
Tabletop power supply unit → Page 239	
Power supply unit for mounting frame → Page 239	
4 mm Safety laboratory cables → Page 247	
EduTrainer → Pages 208 – 218	

### 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 – 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 aims

- 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 1131-3
- IEC 1131-3 programming languages: Function Block Diagram, Ladder Diagram, Statement List, Structured Text and Sequence Language

A PLC (Festo FC34, 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 Controllers, Basic level

Campus licence (→ Page 53):

de	93313
en	93314
es	94427

#### Recommended training media

Textbook Programmable Logic Controllers, Basic level

## Offers for fieldbus training



- Ethernet
- Profibus
- AS-interface
- Vertical integration
- Totally Integrated Automation
- ...

Whichever way you look at it, if you want to stay at the cutting edge you need to know many terms and master the basics of control technology, including networking in the field area.

Festo Didactic offers:

- Orientation seminars for instructors and teachers
- Controllers and control units
- Valves and processes

### Training with training packages

With just a few additions to the Electropneumatics or Electrohydraulics training packages, you can get started with fieldbus training. The required components fit the ER frame or can be mounted on the profile plate with Quick-Fix.

### Training with MPS®

Mechatronics specialists or IT systems electronics specialists are trained on realistic networked systems connected to office automation. The Modular Production System MPS® allows many variations of such training systems to be set up.

### Industrial standard

Training is ideal if use is made of components compatible with industrial standards. That's why we use Festo valve terminals and Siemens controllers.

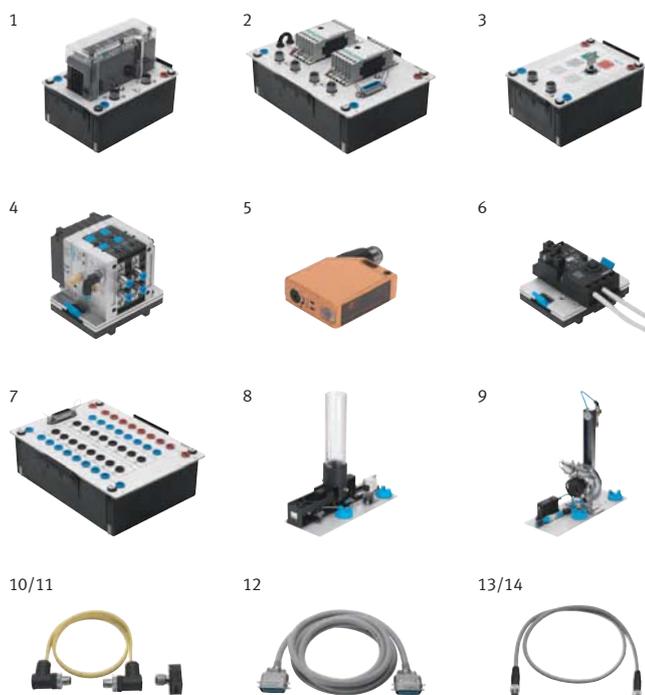
Components for fieldbus training	Masters	Slaves/additional components	Processes
<b>Ethernet/Profinet</b>	– S7-314-2PN/DP	– Trainer Package Simatic WinCC/Web Navigator – TP700/KTP600/KTP400	
<b>Profibus</b>	– S7 EduTrainer® Compact with Profibus-DP* or S7 EduTrainer® Universal with Profibus-DP	– Trainer Packages SIMATIC Basic Panel TP700/KTP600/KTP400 for S7 with WINCC flexible – Valve terminal with Profibus-DP single valve interface**	– Electropneumatics – Programmable logic controllers – MPS® Sorting station with Profibus-DP – TP 402-DP
<b>AS-interface</b>	– S7 EduTrainer® Compact with AS-interface master* or S7 EduTrainer® Universal with AS-interface master	– AS-interface power supply* – AS-interface I/O single valve interface unit with 2 slaves 4 I/4 O* – AS-interface control unit (membrane keyboard) with 4 control elements and 2 displays* – AS-interface reflex light sensor – Valve terminal with AS-interface connection** – AS-interface single valve connector**	– Electropneumatics – Programmable logic controllers – MPS® Distributing station with AS-interface – TP 401-ASI

\* Components for the ER frame.

\*\* Components for the profile plate.

# Equipment set TP 401

## Fieldbus technology AS-interface



Complete equipment set TP 401-ASI **541096**

The most important components at a glance:

1	1x AS-Interface power supply	527426
2	1x AS-Interface I/O connection unit	527427
3	1x AS-Interface control unit	527428
4	1x AS-Interface valve terminal (4 valve slices)	527431
5	1x AS-interface diffuse sensor	532929
6	1x AS interface – Individual valve interface for M8 solenoid valve	533524
7	1x Universal connection unit, digital (SysLink)	162231
8	1x Stack magazine module	527434
9	1x Changer module	527435
10	2x AS-Interface cable, Cable with M12 connector 0.5 m	533032
11	2x AS-Interface cable, Cable con connector M12 1.25 m	533033
12	1x I/O data cable with SysLink connectors (IEEE 488) at both ends, 2.5 m	34031
13	2x Sensor cable M8/M8, 50 cm, 3-pin/3-pin	175488
14	1x Sensor cable M8/M8, 50 cm, 4-pin/3-pin	532930
	1x DUO cable	18685

Programming software:

STEP 7 Trainer Package, de/en/fr/es/it	548573
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Necessary accessories:

Aluminium profile plate → Page 238	
Tabletop power supply unit → Page 239	
Power supply unit for mounting frame → Page 239	
4 mm Safety laboratory cables → Page 247	
PC adapter, USB	539006
TP 400 component set	541099

Recommended accessories (suggestion for S7 EduTrainer® Compact):

CPU-313C-2DP (ER2/19"ASI-SL)	573888
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**Note:** Other variants of the EduTrainer® Compact or Universal with ASI master modules can be combined conveniently in our online configurator based on your individual requirements. Please request a quotation for your individual requirements.

Other accessories:

AS-Interface master CP343-2	526853
Front-panel connector, screwed contacts	184554
AS-Interface addressing device	18959
AS-Interface addressing cable	18960

### Training aims

- Fieldbus systems in automation technology
- Application criteria for fieldbus systems
- Comparison of various fieldbus systems
- Network topologies and access methods
- ISO/OSI 7 layer model
- AS-interface fundamentals
- AS-interface transmission system
- AS-interface master/slave
- Configuration of an AS-interface network with STEP 7
- Connecting, addressing and programming bus stations

### Prerequisites

- A SIMATIC S7-300 with AS-interface master is required for solution of the exercises in this training package.
- The equipment set TP 201 or TP 301 is also required for solution of the exercises. Or additionally order the supplementary TP 400 component set.

Also order:

### Workbook TP 401, AS-interface

Campus licence (→ Page 53):

AS-Interface de	<b>534270</b>
AS-Interface en	<b>534272</b>

# Equipment set TP 402

## Fieldbus technology Profibus-DP

Complete equipment set TP 402-DP **541097**

The most important components at a glance:

1	1x SIMATIC S7 EduTrainer ET 200S	527425
2	1x Profibus-DP valve terminal (8 valve slices), with 16-way input stage	527432
3	2x Universal connection unit, digital (SysLink)	162231
4	1x Stack magazine module	527434
5	1x Changer module	527435
6	2x Profibus cable, 2.0 m	533036
7	2x I/O data cable with SysLink connectors (IEEE 488) at both ends, 2.5 m	34031
8	2x Sensor cable M8/M8, 50 cm, 3-pin/3-pin	175488
9	1x Sensor cable M8/M8, 50 cm, 4-pin/3-pin	532930
10	2x Sensor cable M8/safety plug, 3-pin/3-pin, 100 cm	184123
	1x Sensor cable M8/safety plug, 4-pin/3-pin, 100 cm	534638

Programming software:

STEP 7 Trainer Package, de/en/fr/es/it	548573
--	--------

Necessary accessories:

Aluminium profile plate → Page 238	
Tabletop power supply unit → Page 239	
Power supply unit for mounting frame → Page 239	
4 mm Safety laboratory cables → Page 247	
PC adapter, USB	539006
TP 400 component set	541099

Recommended accessories (suggestion for S7 EduTrainer® Compact):

CPU 314C-2PN/DP (ER1/19"SL)	576626
CPU 313C-2DP (ER2/19"ASI-SL)	573888

**Note:** Other variants of the EduTrainer® Compact or Universal with ASI master modules can be combined conveniently in our online configurator based on your individual requirements. Please request a quotation for your individual requirements.

### Training aims

- Fieldbus systems in automation technology
- Application criteria for fieldbus systems
- Comparison of various fieldbus systems
- Network topologies and access methods
- ISO/OSI 7 layer model
- Profibus-DP fundamentals
- Profibus-DP transmission system
- Profibus-DP master/slave
- Configuration of a Profibus-DP network with STEP 7
- Connecting, addressing and programming bus stations

### Prerequisites

- A SIMATIC S7-300 with Profibus-DP master is required to solve the exercises in this training package.
- The equipment set TP 201 or TP 301 is also required to solve the exercises. You can additionally order the supplementary TP 400 component set.

Also order:

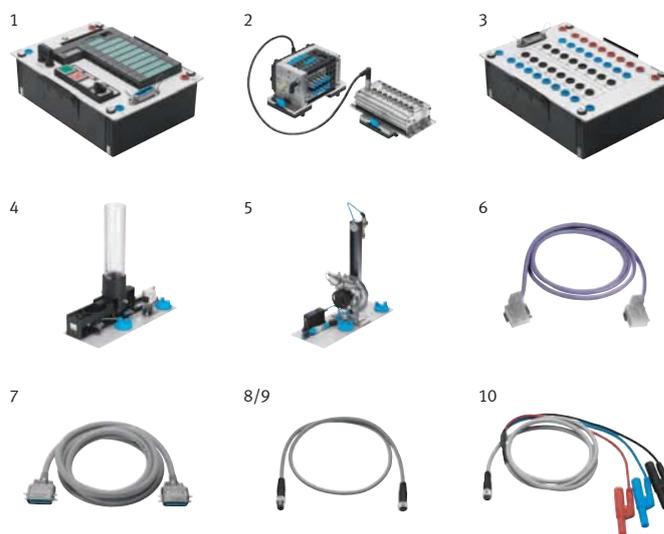
### Workbook TP 402 Profibus-DP

Campus licence (→ Page 53):

Profibus-DP de	<b>534271</b>
Profibus-DP en	<b>534273</b>

### Recommended training media

- Textbook Programmable logic controllers, Basic level
- Self-tuition program, Fundamentals of fieldbus technology
- CD-ROM "Examples for training with STEP 7, AS-interface and Profibus-DP as well as Powerpoint slide shows on AS-interface, distributed automation with Profibus-DP and valve terminals".



# Supplementary equipment sets

## Fieldbus technology



### TP 401 supplementary equipment set DP

This supplementary equipment set enables you to carry out the exercises described in TP 402-DP using an existing TP 401-ASI. This facilitates training in ASI or Profibus-DP.

Complete TP 401 supplementary equipment set DP **541098**

The most important components at a glance:

1	1x SIMATIC S7 EduTrainer ET 200S	527425
2	1x Profibus-DP valve terminal (8 valve slices), with 16-way input stage	527432
3	1x Universal connection unit, digital (SysLink)	162231
4	2x Profibus cable, 2.0 m	533036
5	1x I/O data cable with SysLink connectors (IEEE 488) at both ends, 2.5 m	34031
6	2x Sensor cable M8/safety plug, 3-pin/3-pin, 100 cm	184123
	1x Sensor cable M8/safety plug, 4-pin/3-pin, 100 cm	534638



### TP 400 component set

This supplementary set is required to carry out the exercises from TP 401-ASI and TP 402-DP if TP 201 and TP 301 equipment sets respectively are not available and/or cannot be used.

Complete TP 400 component set **541099**

The most important components at a glance:

1	1x Signal input, electrical	162242
2	1x Indicator unit and distributor, electrical	162244
3	2x Proximity sensor, electronic, with cylinder mounting	2344752
4	1x 5/2-way double solenoid valve with LED	567200
5	1x 5/2-way solenoid valve with LED	567199
6	1x Double-acting cylinder	152888
7	1x Start-up valve with filter control valve	540691
8	1x Manifold	152896

# Interfaces to the process

<p><b>With an EduTrainer® or any PLC, you can control the process of your choice.</b></p> <p>The programmer (PC), controller and processes are connected via various interfaces.</p>	<p><b>1. Simulation of the PLC inputs and display of the PLC outputs</b></p> <p>Testing a PLC program using the simulation box.</p>	<p><b>2. Control of virtual processes</b></p> <p>Industry-oriented, cost effective PLC training by means of simulation software, e.g. CIROS.</p>	<p><b>3. Process model: Control of actual modules</b></p> <p>Using equipment sets, MPS® stations or MPS® PA stations.</p>
<p><b>EduTrainer® or PLC of your choice</b></p>			
<p><b>I/O data cab</b> with SysLink connectors for EduTrainer® at both ends (order no. 034031/167197) or with SysLink connectors at one end and open cable end sleeves for any PLC (order no. 167122)</p>			
<p><b>Interface</b> EasyPort USB (order no. 548687)</p>			
<p><b>Cable set</b> with safety plugs (order no. 167091)</p>			
<p><b>Process model</b></p> <ul style="list-style-type: none"> <li>- Digital simulation box (order no. 170643) or Digital/analogue simulation box (order no. 526863)</li> <li>- Simulation software CIROS® FluidSIM® EasyVeep</li> <li>- Equipment sets, MPS® stations or MPS® PA stations</li> </ul>			

## Accessories/Optional components for training packages





General .....	238
Pneumatics .....	240
Hydraulics .....	242
Electrical engineering/Electronics.....	247
Automation technology/PLC .....	253
Order means .....	256

# Accessories and optional components

## General



**1 Aluminium profile plate**  
The anodised aluminium 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



**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 aluminium profile plate. One set is required to mount one unit.

Order no. **541122**



**5 A4 ER mounting frame**  
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 Vernier caliper**  
– Measuring range: 0 – 150 mm  
– Resolution: 0.01 mm  
– Display: LCD display, 5-digit  
– Power supply: 1.5 V button cell

Order no. **35653**

**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 dimensions B x H)

# Accessories and optional components

## General

### 1 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. **162416**

With IEC power cable, 1.3 m, with:  
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**

### 2 EduTrainer® 24 V power supply unit

- Input voltage: 1 AC/110 – 230 V (47 – 63 Hz)
- Output voltage: 24 V DC, short-circuit-proof
- Output current: Max. 4.5 A
- Front plate: 133 x 297 mm
- Console housing with rubber feet for use in an A4 frame or on tabletop
- Connection via 4 mm safety plugs
- Through-hole for 3 AC/400 V

Order no. **571813**

### 3 Power supply unit for mounting frame

- Input voltage: 85 – 265 V AC (47 – 63 Hz)
- Output voltage: 24 V DC, short-circuit-proof
- Output current: max. 4.5 A
- Dimensions: 170 x 240 x 92 mm

Without power cable  
Order no. **159382**

With IEC power cable, 1.3 m, with:  
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**

### 4 5-fold plug socket strip with switch

Impact and shatter resistant plug socket strip with tamper-proof cover, 4 mounting points and mounting attachments.

With power supply plug suitable for: DE, FR, NO, SE, FI, PT, ES, AT, NL, BE, GR, TR, IT, DK, IR, ID

Order no. **380707**

### 5 IEC power cable

One side designed as a connector and one side with a country-specific plug.

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. **247661**

Connector as per NEMA 5-15 for US, CA, Central America, BR, CO, EC, KR, TW, TH, PH, JP

Order no. **350362**

Connector as per BS 1363 for GB, IE, MY, SG, UA, HK, AE

Order no. **350363**

Connector as per AS 3112 for AU, NZ, CN, AR

Order no. **350364**

Connector as per SEV 1011 for CH

Order no. **350366**

Connector as per SANS 164-1 for ZA, IN, PT, SG, HK, (GB), (AE)

Order no. **350367**

### 6 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**



# Accessories and optional components

## Pneumatics



### 1 Plastic tubing

Very flexible and pressure secure.

4 x 0.75 silver 10 m	151496
3 x 0.5 silver 5 m	197118
6 x 1 silver 5 m	152963

Minimum order quantity/packaging unit quantity: 50 m

4 x 0.75 silver	152584
4 x 0.75 blue	159662
4 x 0.75 black	159663
4 x 0.75 red	178410
4 x 0.75 yellow	178417
4 x 0.75 green	178424



### 2 Pipe and tubing cutter

For plastic and Perbunan tubing with and without fabric reinforcement with outside diameters up to 20 mm. Ensures a vertical, burr-free cut through positive locking of tubing in the cutter. It also has a safety clip to prevent unauthorized opening. Supplied with two spare blades.

Order no.	7658
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### 3 Tubing cutter

For optimal cutting of plastic tubing.

Order no.	255851
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### Releasing tool

For releasing all QS connectors for tubing outside diameters of 3 to 10 mm.

Order no.	158419
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### 4 Multiple tubing holder strip set

Multiple tubing holder strip for aluminium profile plate. Easily attaches to the aluminium slotted profile plate; a neat solution for up to 6 tubes/cables per strip. Set of 10.

Order no.	544317
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### 5 Accessory box

The accessory box contains pneumatic connectors and tubing accessories as well as a tubing cutter and releasing tool for pneumatic connectors.

Order no.	167020
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### 6 T-connector

#### (Quick Star quick push-in fitting)

Precision barbed T connector for quickly establishing branches with low amounts of power, for plastic tubing, 4 mm outside diameter (calibrated).

- Simply “plug and work”
- Flexible assembly – all fittings can be rotated 360° around the threaded part
- Absolutely safe and secure – with an NBR plastic seal
- Multiple use – thread with self-sealing PTFE coating

Minimum order quantity/packaging unit quantity: 10 pieces

- Type 1 Straight fitting, M5 (QSM-M5-4)
- Type 2 Straight fitting, G1/8 (QS-G1/8-4)
- Type 3 Elbow connector, rotatable, M5 (QSM-L-M5-4)
- Type 4 Elbow connector, rotatable, G1/8 (QSL-G1/8-4)
- Type 5 Elbow connector, 4H (QSL-4H)
- Type 6 Straight fitting, self-closing, M5 (QSK-M5-4)
- Type 7 Straight fitting, self-closing, G1/8 (QSK-G1/8-4)
- Type 8 T-connector (QST-4)
- Type 9 T-connector (QST-6)
- Type 10 Plug-in bulkhead connector (QSMS-4)
- Type 11 Blanking plugs (QSC-4H)
- Type 12 Push-in sleeve (QSH-4)
- Type 13 Push-in connector (QSM-6H-4)

Type 1	153304
Type 2	186095
Type 3	153333
Type 4	186116
Type 5	153056
Type 6	153291
Type 7	186294
Type 8	153128
Type 9	153129
Type 10	153376
Type 11	153267
Type 12	153251
Type 13	153329



### Silencer and sealing rings

Minimum order quantity/packaging unit quantity: 10 pieces

Silencer U-M5	
Order no.	4645
Sealing ring OL-M5	
Order no.	34634
Silencer U-1/8	
Order no.	2307
Sealing ring OL-1/8	
Order no.	33840

### 7 Compressor

Oil-lubricated, extremely quiet (45 dB (A)) compressor. Ideally suited for use in classrooms. With pressure regulator and water separator.

- Pressure: 800 kPa (8 bar) P<sub>max</sub>
- Performance: 50 l/min
- Reservoir capacity: 24 l
- Compressed air outlet: 1/4" or KD4
- Noise level: 45 dB (A)/1 m
- Duty cycle: max. 50 %
- Pressure regulator valve with gauge

- Design: 230 V/50 Hz  
With fully insulated socket and IEC power cable suitable for: DE, FR, NO, SE, FI, PT, ES, AT, NL, BE, GR, TR, IT, DK, IR, ID.
- Design: 100 – 120 V/50 – 60 Hz  
With fully insulated socket and IEC power cable suitable for: US, CA, Central America, BR, CO, EC, KR, TW, TH, PH, JP.

230 V	91030
100 – 120 V	565440

### Compressor accessories

Consisting of:

- Coupling socket (KD3-CK-4 and KD4-1/4-A)
- Coupling plug (KS4-CK-4)
- Tubing (6 x 1 silver 2,5 m)

Order no.	102725
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# Accessories and optional components

## Pneumatics

### 1 On-off valve with filter/regulator, 5 µm

Filter regulator valve with pressure gauge, on-off valve, quick push-in connectors and quick coupling plug, mounted on a swivel support. The filter with water separator removes dirt, pipe sinter, rust and condensed water. The pressure regulator maintains the supply air pressure at the set operating pressure and compensates pressure fluctuations. The filter bowl has a condensate drain valve.

The on-off valve pressurises and vents the entire control system. The 3/2-way valve is actuated by a rotary button.

- Design: Piston regulator valve with sintered filter and water trap
- Standard nominal flow rate\*: 1600 l/min
- Input pressure: max. 1600 kPa (16 bar)
- Working pressure: max. 1200 kPa (12 bar)
- Grade of filtration: 5 µm
- Condensate quantity: 43 cm<sup>3</sup>
- Connector: G 1/8, QS-6 for plastic tubing PUN 6 x 1

Order no. **526337**

\* Input pressure: 1000 kPa (10 bar)  
Operating pressure: 600 kPa (6 bar)  
Differential pressure: 100 kPa (1 bar)

### 2 One-way flow control valve

One-way flow control valve on Quick-Fix safety and quick mounting system for profile plates

- Pressure range: 0.2 – 10 bar
- Standard nominal flow rate in direction of flow control: 0 – 110 l/min
- QS-4 connection

Order no. **560159**

### 3/4 Universal adapter

The adapter enables Festo pneumatic components and those of other manufacturers to be mounted on the aluminium profile plate. You can continue to use your existing components and still benefit from the advantages of using the aluminium profile plate system and the Quick-Fix mounting system from Festo Didactic:

- Plug-in, clamp, ready – no force required
- No worn-out sockets
- Exact positioning of components
- Working in a third dimension
- Universally suitable for Festo and third-party components

You can mount the components onto the adapter yourself. It is quick, easy and reliable with slotted screws (included in scope of delivery). Available in two sizes. The adapters are thus universally usable for an enormous number of components with a through hole – regardless of the manufacturer.

Not suitable for mounting of hydraulic components.

3 75 x 50 x 30 mm **195224**

4 75 x 100 x 30 mm **195225**

### 5 Quick-Fix screw adapter

The Quick-Fix screw adapter makes it possible to attach components to a slotted profile plate.

Order no. **549806**

### 6 Quick-Fix clamping adapter

The Quick-Fix clamping adapter makes it possible to attach small components on a slotted profile plate.

Order no. **8026327**

### 7 Stepper module, expansion

The stepper controller is obtained from the series connection of four type TAA basic modules. This module comprises a memory (5/2-way double pilot valve) with display and manual override as well as an AND and OR gate.

Order no. **152885**

### 8 3/2-way roller lever valve, normally open

- Type: Poppet valve, indirectly actuated in one direction, with spring return
- Pressure range: 280 – 800 kPa (2.8 – 8 bar)
- Standard nominal flow rate 1...2: 120 l/min

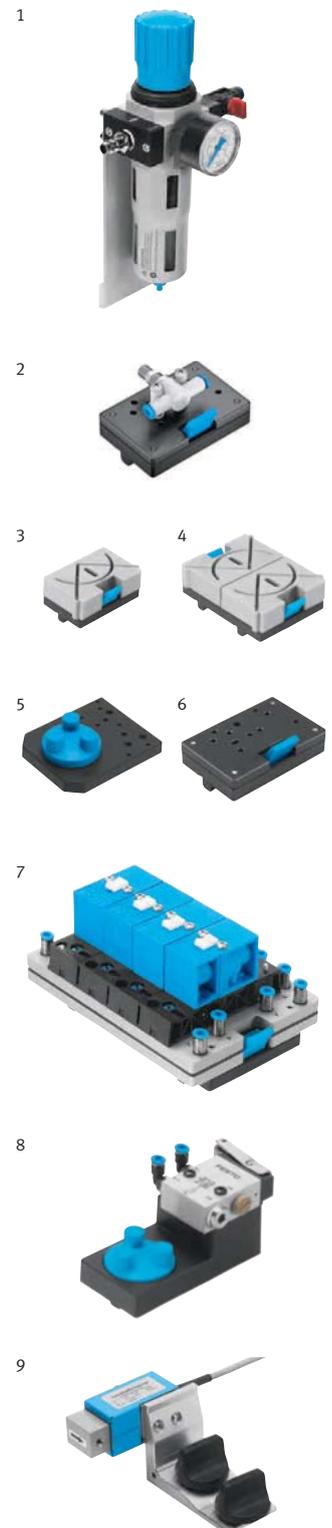
Order no. **162267**

### 9 Force sensor

Force sensor for piston force measurement in the TP 210. Mounting is performed on a slotted profile plate using two T-head nuts. Electrical connection is by means of 4 mm safety plugs.

- Measuring range: 0 – 1 kN
- Supply voltage: 24 V DC
- Output voltage: 0 – 10 V

Order no. **539780**



# Accessories and optional components

## Hydraulics – Drives



**Differential cylinder with cover**  
 – Operating pressure 6 MPa (60 bar)  
 – Maximum permissible pressure 12 MPa (120 bar)  
 – Double-acting  
 – Low-leakage, self-sealing coupling nipples  
 – Quick action mounting system Quick-Fix®



**16/10/200**  
 – Piston Ø: 16 mm  
 – Piston rod Ø: 10 mm  
 – Stroke: 200 mm  
 – Surface area ratio 1 : 1.6

Order no. **572746**



**16/10/300**  
 – Piston Ø: 16 mm  
 – Piston rod Ø: 10 mm  
 – Stroke: 300 mm  
 – Surface area ratio 1 : 1.6

Order no. **572748**



**1 16/10/400**  
 – Piston Ø: 16 mm  
 – Piston rod Ø: 10 mm  
 – Stroke: 400 mm  
 – Surface area ratio 1 : 1.6

Order no. **572749**



**2 25/18/200**  
 – Piston Ø: 25 mm  
 – Piston rod Ø: 18 mm  
 – Stroke: 200 mm  
 – Surface area ratio 1 : 2

Order no. **572747**



**3 Steady-speed cylinder with covers**  
 – Operating pressure 6 MPa (60 bar)  
 – Maximum permissible pressure 12 MPa (120 bar)  
 – Double-acting  
 – Low-leakage, self-sealing coupling nipples  
 – Quick action mounting system Quick-Fix

– Piston Ø: 16 mm  
 – Piston rod Ø: 2 x 10 mm  
 – Stroke: 200 mm  
 – Surface area ratio 1 : 1

Order no. **572750**



**7 Displacement encoder for cylinder**  
 Linear potentiometer for installing on cylinders using a mounting kit.  
 – Connecting cable with 4mm safety plug  
 – Output: 0 – 10 V (DC)

**200 mm measuring stroke**  
 for cylinders order no. 572746 and 572750 with mounting kit order no. 544371 or for cylinders order no. 572747 with mounting kit order no. 544373

200 mm stroke **167090**

**300 mm measuring stroke**  
 for cylinders order no. 572748 with mounting kit order no. 544372

300 mm stroke **525953**

**450 mm measuring stroke**  
 for direct mounting on cylinders order no. 184488 and aluminium profile plate

450 mm stroke **525954**

**Weight, 9 kg for cylinder**  
 Weight for mounting on a Learnline profile column. Can be used as the driving or tractive load of a hydraulic cylinder. With clevis and plain-bearing guide. For cylinder: order no. 152857, 572746, 572750

Order no. **152972**

**8 Protective cover for weight, 9 kg**  
 Protects reliably against injury. Only in combination with cylinder, order no. 152857, 572746, 572750 and weight, order no. 152972.

For Learnline profile column

Order no. **541135**

For the Learntop-S mounting kit

Order no. **152973**



**4 Loading unit/cylinder load simulator**

With this combination, a hydraulic counteracting force can be applied to a differential or steady-speed cylinder, allowing a wide range of load situations to be set up and investigated. Available options include differential against differential (2 x 1 : 1.6), small steady-speed against large steady-speed, or large steady-speed against small steady-speed cylinder.

– Operating pressure 6 MPa (60 bar)  
 – Maximum permissible pressure 12 MPa (120 bar)

– Integrated safety valve  
 – Double-acting (2 x)

– Low-leakage, self-sealing coupling nipples

– Quick action mounting system Quick-Fix

– Piston Ø: 2 x 16 mm

– Piston rod Ø: 10 mm

– Stroke: 200 mm

– Surface area ratio 1 : 1 or 1 : 1.6

Order no. **572145**

**5 Cover for cylinder**

Reduces the risk of injury. With a guide for easy positioning of limit switches and proximity sensors. Also suitable for cylinders with mounting kit. Use two covers for cylinders with a stroke of more than 200 mm. With quick action mounting system Quick-Fix. For all differential and double rod cylinders.

Order no. **556290**

**6 Mounting kit for cylinders**

Fitting a mounting kit on a cylinder makes the following possible:

– Actuation of the stem actuated valve by the guide bar

– Actuation of proximity sensors (order no. 2342009) by the permanent magnet of the guide bar

– Use of a displacement encoder

For cylinder 572746, 572750, 572145

Order no. **544371**

For cylinder 572748

Order no. **544372**

For cylinder 572747

Order no. **544373**

You can find our complete range of hydraulic components at [www.festo-didactic.com](http://www.festo-didactic.com)

# Accessories and optional components

## Hydraulics – Hosing/Distributing

### 1 Hose line with quick release couplings

The high-pressure hose consists of three layers: The innermost layer is synthetic rubber, followed by a wire mesh and sheath of abrasion-resistant synthetic rubber. The quick coupling sockets are self-sealing when decoupled. Used with a coupling nipple, the coupling sockets form a tightly sealed connection. Only the face of the coupling is coated with oil during the coupling process. Coupling and decoupling are only permissible when the hose is depressurised.

- Operating pressure 6 MPa (60 bar)
- Max. permissible pressure 12 MPa (120 bar)
- Temperature range -40 – + 125 °C
- Min. bending radius 100 mm
- DN 06 (Ø 6,3 mm)

600 mm	152960
1000 mm	152970
1500 mm	159386
3000 mm	158352

### Resistance hose line with quick release couplings

DN 04 (Ø 4 mm)

1000 mm	549858
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### Hose line without quick release couplings

With G 1/4" external thread and spanner flat (AF19). Please observe the following safety rules: Hoses should not be used for longer than 6 years, including a storage period of 2 years.

600 mm	337617
1000 mm	337618
1500 mm	350337
3000 mm	343616

### Coupling socket

- Maximum permissible pressure 12 MPa (120 bar)
- Low-leakage, self-sealing quick coupling socket
- G $\frac{1}{4}$ " thread

Internal thread	567223
External thread	548610

### Coupling nipple

- Maximum permissible pressure 12 MPa (120 bar)
- Low-leakage, self-sealing coupling nipple
- G $\frac{1}{4}$ " male thread

Order no.	342047
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### Blanking plug

To seal off connecting threads that are not needed.

- Maximum permissible pressure 12 MPa (120 bar)
- G $\frac{1}{4}$ " male thread

Order no.	205284
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### Sealing ring for blanking plug

Order no.	34635
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### 2 T-distributor

The distributor can be inserted at any point.

- Ports: 2x coupling nipples and 1x quick coupling socket
- Maximum permissible pressure 12 MPa (120 bar)
- Low-leakage, self-sealing couplings

Order no.	152847
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### 3 4-way distributor

Distributor with five ports.

- Maximum permissible pressure 12 MPa (120 bar)
- Low-leakage, self-sealing coupling nipples
- Quick action mounting system Quick-Fix

Order no.	184455
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### 4 4-way distributor with pressure gauge

The distributor with five ports is equipped with a pressure gauge and is firmly screwed to the profile plate.

- Effective range and maximum permissible pressure 10 MPa (100 bar)
- Quality class 1.6% of the full scale value
- Operating pressure, static: 3/4 of the full scale value
- Operating pressure, dynamic: 2/3 of the full scale value
- Cushioning: glycerine
- Low-leakage, self-sealing coupling nipples

Order no.	159395
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### 5 Pressure relief unit

The pressure relief unit is attached to the low-leakage, self-sealing coupling nipple so it can be forced open without requiring much power. This allows trapped hydraulic pressures to be relieved.

Order no.	152971
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### Base plate

Base plates with four G $\frac{1}{4}$ " threaded connections and valve port patterns to ISO/DIN 4401. For the adaptation of any valves. Quick action mounting system Quick-Fix.

Size 02 (NG4)

Order no.	572152
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Size 02 (NG4), AB rotated

Order no.	572153
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Size 03 (NG6)

Order no.	669198
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Size 03 (NG6), AB rotated

Order no.	750227
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### 6 Tubing line for unpressurised return

For connecting open connection fittings to the return header or the plug socket on the hydraulic power unit.

- Maximum permissible pressure 1 MPa (10 bar)
- One side with open quick coupling plug, one side with quick coupling socket
- Length 1200 mm

Order no.	573024
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### 7 4-way return header, unpressurised

Plate with five ports to bring together multiple safety-oriented return lines. The open quick coupling plug is routed back to the tank of the hydraulic power unit.

- Maximum permissible pressure 1 MPa (10 bar)
- Four self-sealing quick coupling sockets
- A tube (2 m) with open quick coupling plug

Order no.	573026
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# Accessories and optional components

## Hydraulics – Power packs



### 1 Hydraulic power pack with two constant-displacement pumps and two motors, AC

Especially suitable for separate supply of two hydraulic circuits each with its own ON/OFF switch e.g. on a mobile Learnline workstation. Equally recommended for reaching higher speeds in cylinders and motors. Also ideal for producing valve characteristic curves.

- Can be integrated into mobile Learnline workstation systems from 2005 onwards
- Pump design: 2 x external gear motor each with pressure relief valve adjustable from 0 – 6 MPa (0 – 60 bar)
- Operating pressure 6 MPa (60 bar)
- Two motors with overload protection, and each with an ON/OFF switch on the Quick-Fix mounting system
- Tank: 40 l volume, sight glass, temperature display, drain screw
- Tank lid with air filter and return filter
- Low-leakage, self-sealing coupling nipples for P and T
- Plug socket for unpressurised return
- Connecting flange for measuring container return
- Dimensions: 700 x 320 x 550 mm (W x D x H)
- Weight: 72 kg

- Power pack with AC motors
- Single-phase and start capacitors
- Nominal voltage: 230 V
- Rated output: 2 x 550 W
- Frequency: 50 Hz
- Delivery rate (rated speed): each 3.7 l/min/1400 r.p.m.

Order no. **541114**

### Hydraulic power pack with two fixed displacement pumps and two three-phase AC motors

- Power pack with three-phase AC motors
- Nominal voltage: 400 – 460 V
- Rated output: 2 x 550 W
- Frequency: 50 – 60 Hz
- Delivery rate (rated speed): each 3.7 – 4.5 l/min at 1400 – 1740 r.p.m.

Order no. **541116**

### 2 Hydraulic power pack with LS variable and constant displacement pump combination, three-phase AC

Especially well-suited to all tests with the TP 800 standard equipment sets and other mobile hydraulics applications, especially processes controlled with load sensing (LS).

- Can be integrated into mobile Learnline workstation systems from 2005 onwards
- Pumps: vane pump with hydraulic load-sensing controller limited to 4,2 l/min delivery rate at 1,000 min<sup>-1</sup> and external gear pump with pressure-relief valve adjustable to 0 – 6 MPa (0 – 60 bar), delivery rate of constant displacement pump: 4.1 l/min at 1,000 min<sup>-1</sup>
- Operating pressure 6 MPa (60 bar)
- Motor with overload protection and an ON/OFF switch on quick action mounting system Quick-Fix
- Tank: 40 l, sight glass, temperature display, drain screw
- Tank lid with air filter and return filter
- Low-leakage, self-sealing coupling nipples for P and T
- Plug socket for unpressurised return
- Connecting flange for measuring container return
- Dimensions: 805 x 335 x 540 mm (W x D x H)
- Weight: 105 kg

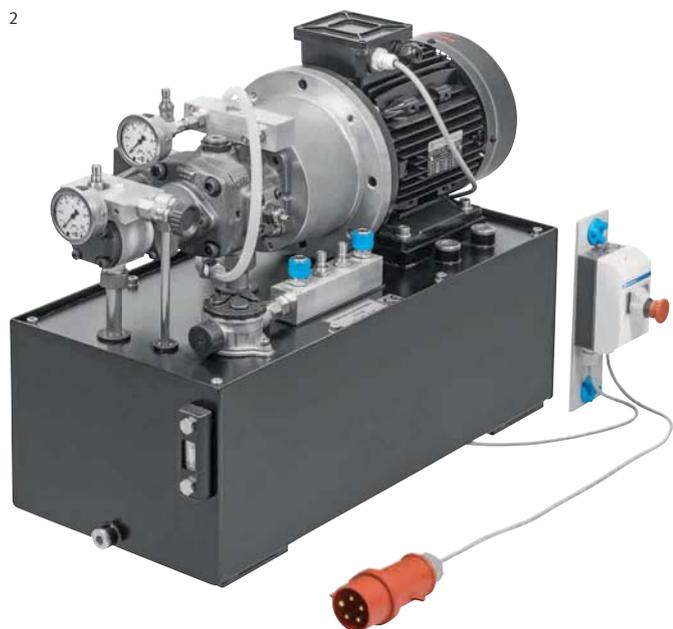
- Power unit with three-phase motor
- Motor data: 380 – 420 V; 2.2 kW; 50 Hz
- CEE plug (Cekon) 16 A

Order no. **572128**

### Variants

- Motor data:
- 220 – 245 V (3 x 127 – 141 V); 2.2 kW; 50 Hz
  - 220 – 280 V (3 x 127 – 161 V); 2.2 kW; 60 Hz
  - 380 – 480 V (3 x 220 – 277 V); 2.2 kW; 60 Hz

Order no. **On request**



### 3 Wheel set for mounting on the tank

- Suitable for hydraulic power units with 40 l tank
- Four guide rollers, of which two with locking brake
- Mounting material included

Order no. **539734**

# Accessories and optional components

## Hydraulics – Power packs

### 1 Hydraulic power pack with two constant-displacement pumps and one motor, AC

Recommended for reaching higher speeds in cylinders and motors. Also ideal for producing valve characteristic curves.

- Can be integrated into mobile Learnline workstation systems from 2005 onwards
- Pump design: 2 x external gear motor each with pressure relief valve adjustable from 0 – 6 MPa (0 – 60 bar)
- Operating pressure 6 MPa (60 bar)
- Motor with overload protection, and ON/OFF switch on Quick-Fix mounting system
- Tank: 40 l volume, sight glass, temperature display, drain screw
- Tank lid with air filter and return filter
- Low-leakage, self-sealing coupling nipples for P and T
- Plug socket for unpressurised return
- Connecting flange for measuring container return
- Dimensions: 700 x 320 x 550 mm (W x D x H)
- Weight: 65 kg

- Power pack with AC motor, single-phase and start capacitor
- Nominal voltage: 230 V
- Rated output: 1.1 kW
- Frequency: 50 Hz
- Delivery rate (rated speed): 2 x 3.7 l/min at 1400 r.p.m.

Order no. **539733**

### Hydraulic power pack with two fixed displacement pumps and one three-phase AC motor

- Power pack with three-phase AC motor
- Nominal voltage: 400 – 460 V
- Rated output: 1.1 kW
- Frequency: 50 – 60 Hz
- Delivery rate (rated speed): 2 x 3.7 – 4.5 l/min at 1400 – 1740 r.p.m.

Order no. **541115**

Additional hydraulic power units and configurations on request.

### 2 Hydraulic power pack with a constant-displacement pump, 230 V

Ideal for individual hydraulic workstations for all experiments using standard equipment sets TP 500, 600 and the MPS® punching station.

- Mounting on Learnline with universal bracket (order no. 539736)
- Mounting on Learntop-S: direct
- Pump design: external gear motor with pressure relief valve adjustable from 0 – 6 MPa (0 – 60 bar)
- Operating pressure 6 MPa (60 bar)
- Motor: AC, single-phase with overload protection, start capacitor and ON/OFF switch
- Tank: 5 l volume, sight glass, temperature display, drain screw
- Air filter and return filter
- Low-leakage, self-sealing coupling nipples for P and T
- Plug socket for unpressurised return
- Connecting flange for measuring container return
- Dimensions: 580 x 300 x 180 mm (W x D x H)
- Weight: 19 kg

- Nominal voltage: 230 V AC
- Rated output: 0.65 kW
- Frequency: 50 to 60 Hz
- Delivery rate (rated speed): 2.2 – 2.7 l/min at 1320 – 1680 m<sup>3</sup>

Order no. **152962**

### Hydraulic power pack with a fixed displacement pump, 110 – 127 V

- Nominal voltage: 110 – 127 V AC
- Rated output: 0.55 kW
- Frequency: 60 Hz
- Plug to US standard
- Delivery rate (rated speed): 2.7 l/min at 1680 m<sup>3</sup>

Order no. **159328**

All 230 V power packs with power plug CEE 7, suitable for: DE, FR, NO, SE, FI, PT, ES, AT, NL, BE, GR, TR, IT, DK, IR, ID.

Note:  
For safety reasons the hydraulic power packs are not filled with oil when delivered. Please order the oil separately.

1



2



### 3 Hydraulic oil (DIN 51524)

Brand-name hydraulic oil for all Festo hydraulic power units.

HLP22, 10 Litres

Order no. **192215**

HLP22, 20 Litres

Order no. **14572**

### Funnel

Funnel for filling various devices with oil.

Order no. **374038**

3



# Accessories and optional components

## Hydraulics – Additional components



### 1 Measuring case

The complete measuring set is packaged in the practical and sturdy Systainer. It can be used for commissioning, maintenance, troubleshooting and optimisation of hydraulic circuits.

Complete measuring case, consisting of:

- Flow rate measuring device, electronic: 0 – 10 V analogue output corresponds to 0 – 10 litres per minute or 0 – 1220 RPM.
- Can only be operated with a hydraulic motor (Order no. 152858). Order no. 567191
- Measuring line, 500 mm, red: Order no. 376937
- Measuring line, 500 mm, blue: Order no. 376936
- Digital multimeter: Order no. 571832

- Pressure sensor, measuring range 0 – 10 MPa (0 – 100 bar), nominal size 4: Order no. 525964
- Temperature sensor, measuring range 0 – 100 °C, nominal size 4: Order no. 525963

Order no. **177468**

### 2 Pressure sensor

The pressure sensor can be inserted at any point for pressure measurement and has an analogue output.

- Operating voltage 15 – 30 V DC
- Effective range and maximum permissible pressure 10 MPa (100 bar)
- Analogue output 0 – 10 V
- Electrical connection on 4 mm safety plug
- Low-leakage, self-sealing couplings

Order no. **525964**

### 3 Pressure switch, electronic

The pressure switch can be inserted at any point for pressure measurement and has two switching outputs and an analogue output.

- Operating voltage 18 – 35 V DC
- Switching outputs 2 x PNP, maximum 1.2 A
- Effective range and maximum permissible pressure 10 MPa (100 bar)
- Analogue output 0 – 10 V
- 4-digit digital display, can be rotated along 2 axes
- Electrical connection M12, 5-pin on 4 mm safety plug
- Low-leakage, self-sealing couplings

Order no. **548612**

### 4 Temperature sensor

The sensor can be inserted at any point for temperature measurement and has an analogue output.

- Maximum permissible pressure 12 MPa (120 bar)
- Operating voltage 20 – 30 V DC
- Measuring range 0 – 100 °C
- Analogue output 0 – 10 V
- Electrical connection on 4 mm safety plug
- Low-leakage, self-sealing couplings

Order no. **525963**

### 5 Flow sensor

The sensor is connected to the hydraulic motor (order no. 152858). A tachometer generator transforms the rotational speed of the hydraulic motor into DC voltage. The speed of the hydraulic motor from 0 – 1220 r.p.m. equates to a voltage of 0 – 10 V and a flow rate of 0 – 10 l/min.

- Clockwise/anti-clockwise rotation: output as analogue value from 0 – 10 V
- Operating voltage 24 V DC
- Measuring range 0 – 10 l/min
- Analogue output 0 – 10 V
- Electrical connection on 4 mm safety sockets

Order no. **567191**

### 6 Measuring container for hydraulic oil

The transparent measuring container is equipped with a stabilised inlet, a normal inlet and an inlet for unpressurised return. There is also a scale, protection against overflow, and a manually opened outflow. For mounting on Learnline, the universal bracket (order no. 539736) is required. Measuring range up to 2 litres.

Order no. **541134**

#### Displacement encoder

→ Hydraulics – Drives  
Page 242

#### PC-supported measured data acquisition

→ Equipment sets TP 610 and TP 810

# Accessories and optional components

## Electrical engineering/Electronics

### 4 mm Safety laboratory cables

- Plugs with rigid protective sleeve and axial socket
- Conductor cross section: 1 mm<sup>2</sup>
- 1000 V CAT II
- Rated current: 16 A

### 4 mm Safety laboratory cables, 98 pieces, red and blue

Complete set, consisting of 98 safety laboratory cables with 4 mm safety plugs in the colours red and blue:

- 10x red 50 mm
- 10x blue 50 mm
- 26x red 300 mm
- 11x blue 300 mm
- 21x red 500 mm
- 12x blue 500 mm
- 3x red 1000 mm
- 3x blue 1000 mm
- 1x red 1500 mm
- 1x blue 1500 mm

For the third cable colour, safety laboratory cables, 47 pieces, black, are suitable (order no. 572096)

Order no. **167091**

### 4 mm Safety laboratory cables, 47 pieces, black

Complete set, consisting of 47 safety laboratory cables with 4 mm safety plugs in the colour black:

- 8x black 50 mm
- 18x black 300 mm
- 18x black 500 mm
- 2x black 1000 mm
- 1x black 1500 mm

Order no. **572096**

### 4 mm Safety laboratory cables, 106 pieces, red, blue and black

Complete set, consisting of 106 safety laboratory cables with 4 mm safety plugs in the colours red, blue and black:

- 10x red 50 mm
- 10x blue 50 mm
- 8x black 50 mm
- 8x red 300 mm
- 8x blue 300 mm
- 18x black 300 mm
- 8x red 500 mm
- 8x blue 500 mm
- 18x black 500 mm
- 2x red 1000 mm
- 3x blue 1000 mm
- 2x black 1000 mm
- 1x red 1500 mm
- 1x blue 1500 mm
- 1x black 1500 mm

Order no. **571806**

### 4 mm Safety laboratory cables, 52 pieces, grey and green-yellow

Complete set, consisting of 52 safety laboratory cables with 4 mm safety plugs in the colours grey and green-yellow:

- 6x grey 50 mm
- 15x grey 300 mm
- 2x green-yellow 300 mm
- 12x grey 500 mm
- 2x green-yellow 500 mm
- 6x grey 1000 mm
- 2x green-yellow 1000 mm
- 6x grey 1500 mm
- 1x green-yellow 1500 mm

Order no. **571807**

### 4 mm Safety laboratory cables, 50 mm

red	<b>376932</b>
blue	<b>376931</b>
black	<b>572102</b>
grey	<b>572103</b>

### 4 mm Safety laboratory cables, 300 mm

red	<b>376935</b>
blue	<b>376934</b>
black	<b>572104</b>
grey	<b>572105</b>
yellow	<b>572106</b>
green-yellow	<b>572107</b>

### 4 mm Safety laboratory cables, 500 mm

red	<b>376937</b>
blue	<b>376936</b>
black	<b>572108</b>
grey	<b>572109</b>
yellow	<b>572110</b>
green-yellow	<b>572111</b>

### 4 mm Safety laboratory cables, 1000 mm

red	<b>376939</b>
blue	<b>376938</b>
black	<b>572112</b>
grey	<b>572113</b>
yellow	<b>572114</b>
green-yellow	<b>572115</b>

### 4 mm Safety laboratory cables, 1500 mm

red	<b>376941</b>
blue	<b>376940</b>
black	<b>572116</b>
grey	<b>572117</b>
yellow	<b>572118</b>
green-yellow	<b>572119</b>

### 2 mm Safety laboratory cables

- Plugs with rigid protective sleeve and axial socket
- Conductor cross section: 0,5 mm<sup>2</sup>
- 500 V CAT II
- Rated current: 5 A

### 2 mm Safety laboratory cables, 60 pieces, red, blue and black

Complete set, consisting of 60 safety laboratory cables with 2 mm safety plugs in the colours red, blue and black:

- 11x red 100 mm
- 11x blue 100 mm
- 20x black 100 mm
- 2x red 200 mm
- 2x blue 200 mm
- 10x black 200 mm
- 2x black 300 mm
- 2x black 500 mm

Order no. **574206**

### 2 mm Safety laboratory cables, 100 mm

red	<b>574198</b>
blue	<b>574199</b>
black	<b>574200</b>

### 2 mm Safety laboratory cables, 200 mm

red	<b>574201</b>
blue	<b>574202</b>
black	<b>574203</b>

### 2 mm Safety laboratory cables, 300 mm

red	<b>576297</b>
blue	<b>576298</b>
black	<b>574204</b>

### 2 mm Safety laboratory cables, 500 mm

red	<b>576295</b>
blue	<b>576296</b>
black	<b>574205</b>

### Measuring lead holder

Mobile measuring lead holder with storage box.

- Dimensions (W x H x D)

54 x 135 x 54 cm

- Storage dimensions (W x D)

42 x 51 cm

Order no. **8043430**



# Accessories and optional components

## Electrical engineering/Electronics



### Safety jumper plugs, 42 pieces, red, blue, grey, grey-blue and green-yellow

Complete set, consisting of 42 safety jumper plugs in the colours red, blue, grey, grey-blue and green-yellow:

- 8x red
- 8x blue
- 16x grey
- 4x grey-blue
- 6x green-yellow

- Plugs with rigid protective sleeve
- Plug spacing: 19 mm
- 1000 V CAT II
- Rated current: 16 A

Order no. **571808**

### Safety jumper plugs, 28 pieces, grey-black

Complete set, consisting of 28 grey-black safety jumper plugs. Suitable for the universal patch panel Edu-Trainer®, the jumper plugs are used to clearly establish connections when designing circuits.

- 28x grey-black
- Plugs with rigid protective sleeve
- Plug spacing: 19 mm
- 1000 V CAT II
- Rated current: 16 A

Order no. **571809**

### Safety jumper plugs, 19 mm

- Plugs with rigid protective sleeve
- Plug spacing: 19 mm
- 1000 V CAT II
- Power rating: 16 A

red	<b>572097</b>
blue	<b>572098</b>
black	<b>572099</b>
grey	<b>572100</b>
grey-blue	<b>572120</b>
grey-black	<b>572121</b>
green-yellow	<b>572101</b>

### 1 BNC - 4 mm safety measuring adapter

Measuring lead for BNC plug on 4 mm safety plug

- BNC plug insulated
- 4 mm plug with rigid protective sleeve and axial socket
- 600 V CAT II
- Length: 1600 mm

Order no. **8023959**

### 2 4 mm - 2 mm safety measuring adapter

Measuring adapter 4 mm safety plug on 2 mm safety socket

- With rigid protective sleeve and axial socket
- 600 V CAT II
- Load capacity: 5 A

Order no. **8023960**

### 3 Set of 4 mm angled safety adapters, 20 pc, clevis

Set comprising 20 angled adapters with rigid protective sleeve and open clevis end for the bonding of devices.

- Clevis width 7.5 mm
- Clevis length 12 mm
- Suitable for M4 screws
- 1000 V CAT II
- Load capacity: 16 A

grey	<b>576287</b>
black	<b>576288</b>

### 4 Set of 4 mm angled safety adapters, 20 pc, pin

Set comprising 20 angled adapters with rigid protective sleeve and open pin end for the bonding of devices.

- Pin width 2 mm
- Pin length 12 mm
- 1000 V CAT II
- Load capacity: 16 A

grey	<b>576285</b>
black	<b>576286</b>

# Accessories and optional components

## Electrical engineering/Electronics

### 1 Set of empty component housings, 2-pin

Set of ten 2-pin housings, suitable for equipment set for basic principles of electrical engineering/electronics, consisting of

- Housing upper part, grey, blank
- Housing base, transparent
- Printed circuit board with universal layout and imprinted 4 mm push-in sleeves

For equipment with commercially available 2-pin wired components.

Order no. **576289**

### 2 Set of empty component housings, 3-pin

Set of ten 3-pin housings, suitable for equipment set for basic principles of electrical engineering/electronics, consisting of

- Housing upper part, grey, blank
- Housing base, transparent
- Printed circuit board with universal layout and imprinted 4 mm push-in sleeves

For equipment with commercially available 3-pin wired components.

Order no. **576290**

### 3 Operational amplifier

For constructing amplifier circuits.

- Supply voltage +/-15 V DC via 2 mm safety plug
- Output short circuit proof
- Offset compensation possible with potentiometer
- OP type LM741

Order no. **576621**

### 4 IC zero insertion force socket

High-quality IC socket for tool-free adaptation of ICs, compatible with digital technology.

- 16 pins in a 2.54 mm grid
- Tool-free assembly using clamping lever
- Contacting with 2 mm safety plug

Order no. **576623**

### 5 I/O level converter 5 V ↔ 24 V

I/O level converter for the implementation of digital inputs and outputs for digital technology or microcontrollers on functional models.

- Supply voltage DC/24 V via 4 mm safety plug
- 8 inputs 5 V via 2 mm safety plug
- 8 outputs 5 V via 2 mm safety plug
- SysLink connection with 8 inputs and 8 outputs 24 V
- Acceptable current load per DC/24 V output 300 mA, protected against short circuits and overloads
- Sum of the output currents: max. 2 A

Order no. **576622**

### 6 KNX cable set

Complete set comprising 6 KNX cables. Pre-assembled with KNX system plugs to fit KNX EduTrainers®.

- Conductor cross section: 2 x 2 x 0.8 mm<sup>2</sup>
- 4x 100 mm
- 1x 200 mm
- 1x 1000 mm

Order no. **8023965**

### 7 A4 empty housing

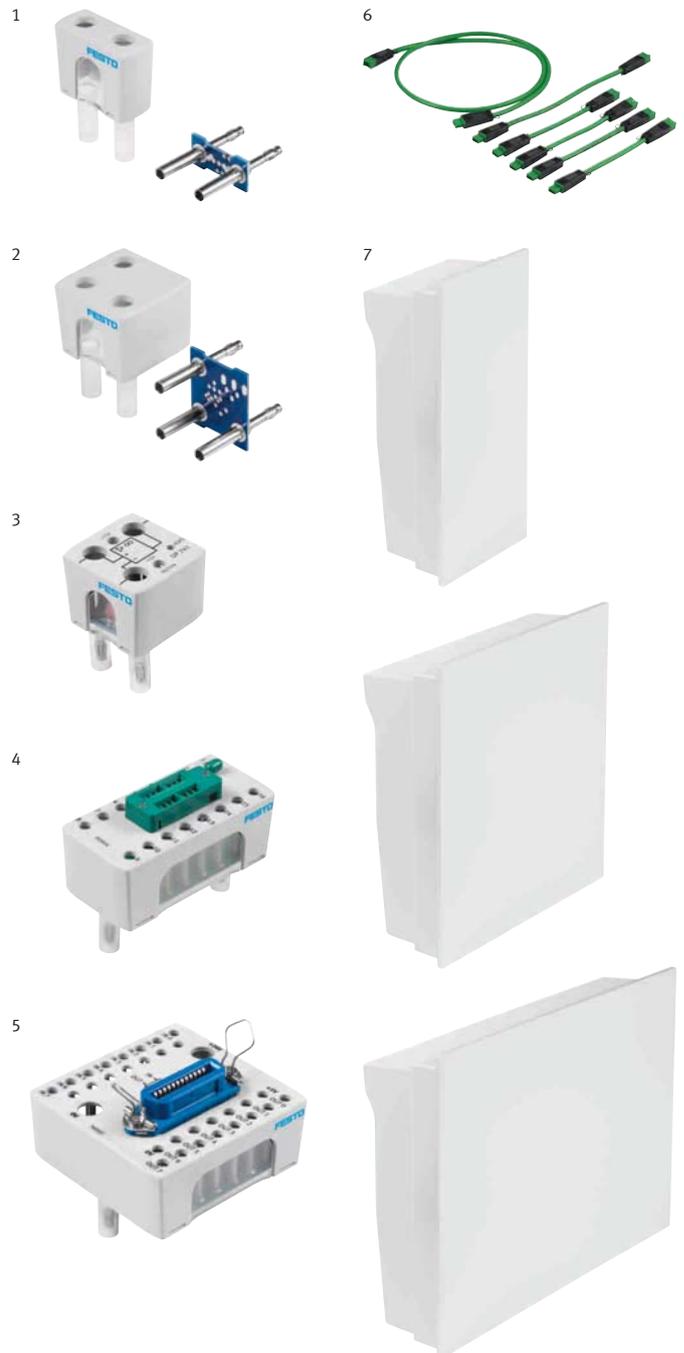
Medium-grey front panel with removable protective sheet, rear cover, rubber feet and screws fully mounted.

- Front panel: 133 x 297 mm
- Front panel: 266 x 297 mm
- Front panel: 399 x 297 mm
- Depth: 90 mm

133 x 297 mm **8023974**

266 x 297 mm **8023975**

399 x 297 mm **8023976**



# Accessories and optional components

## Electrical engineering/Electronics



**1 Fluke 115 digital multimeter**  
Standard meter for basic training in electrical engineering.

Automatic and manual range selection, 4-digit illuminated LCD display for measuring direct and alternating voltage, direct and alternating current, resistance, continuity, frequency, capacitance, diode test, min./max./mean value, display hold, bar graph, true effective value measurement (TRMS).

- Voltage: 0.1 mV – 600 V
- Current: 0.1 mA – 10 A
- Resistance: 0.1 Ω – 40 MΩ
- Frequency: 0.01 Hz – 50 kHz
- Capacitance: 1 nF – 10,000 μF
- Measuring circuit category CAT III/600 V

**Scope of delivery**

- Measuring cables
- Holster
- 9 V battery
- Manual

Order no. **571830**



**2 Fluke 179 digital multimeter**  
Meter for higher requirements in basic training.

Automatic and manual range selection, 4-digit illuminated LCD display for measuring direct and alternating voltage, direct and alternating current, resistance, continuity, frequency, capacitance, diode test, temperature measurement, min./max./mean value, display hold, bar graph, true effective value measurement (TRMS).

- Voltage: 0.1 mV – 1,000 V
- Current: 0.01 mA – 10 A
- Resistance: 0.1 Ω – 50 MΩ
- Frequency: 0.01 Hz – 100 kHz
- Capacitance: 1 nF – 10,000 μF
- Measuring circuit category CAT III/1000 V
- Measuring circuit category CAT IV/600 V

**Scope of delivery**

- Measuring cables
- 80BK temperature probe
- Holster
- 9 V battery
- Manual

Order no. **571831**



**3 Beha-Amprobe AM-510 digital multimeter**  
Simple entry-level device for basic training.

Automatic and manual range selection, 3¾-digit LCD display, measurement of direct and alternating voltage, direct and alternating current, resistance, continuity, flow diode test, capacity and frequency measurement.

- Voltage: 1 mV – 600 V
- Current: 0.1 μA – 10 A
- Resistance: 0.1 Ω – 40 MΩ
- Frequency: 1 Hz – 10 MHz
- Capacity: 0.01 nF – 100 μF
- Measuring circuit category CAT III/600 V

**Scope of delivery**

- Measuring leads
- Battery
- Operating instructions

Order no. **8040005**



**4 Beha-Amprobe AM-550 digital multimeter**  
Low-cost device with a full range of functions for basic training.

Automatic and manual range selection, 3¾-digit LCD display, measurement of direct and alternating voltage, direct and alternating current, resistance, continuity, flow diode test, capacity and frequency measurement, temperature measurement. Min/max, data hold, bar display (61 segments), real effective value measurement (TRMS).

- Voltage: 1 mV – 1000 V
- Current: 0.1 μA – 10 A
- Resistance: 0.1 Ω – 60 MΩ
- Frequency: 1 Hz – 60 MHz
- Capacity: 60 nF – 60 μF
- Measuring circuit category CAT III/1000 V
- Measuring circuit category CAT IV/600 V

**Scope of delivery**

- Measuring leads
- Temperature probe
- Ever-ready case
- Battery
- Operating instructions

Order no. **8040006**

# Accessories and optional components

## Electrical engineering/Electronics

### 1 Fluke 1654B installation tester for VDE 0100

Perfect for practical demonstration of electrical protective measures in combination with our EduTrainers® for mains systems and protective measures, in particular for testing type B RCDs as well.

For testing and accepting fixed installations to VDE 0100/0413, the international standard IEC 60364 and the European standard EN 61557. The easy-to-use controller and the large display with a wide viewing angle make for user-friendly and safe operation. For all basic installation tests including continuity, insulation, loop impedance, trigger time and trigger current of residual current protective devices (residual current devices), measuring earthing resistance and phase sequence. Includes internal memory and PC interface for documentation and reporting.

#### Scope of delivery

- Hardshell case
- Probe, measuring cables
- Set of standard measuring cables
- Quick guide, CD manual
- 6 AA batteries
- Padded carrying strap

Order no. **576282**

#### Software for Fluke

##### 1653B/1654B DMS 0100/INST

Fluke DMS (Data Management Software) for recording data and managing test results when testing electrical installations as per DIN VDE 0100.

Order no. **571838**

### 2 Beha-Amprobe Telaris ProInstall-0100 installation meter

Low-cost installation tester with a good range of functions for testing the safety of electrical systems and work with our EduTrainers® for power supply systems and protective measures, without test options for RCDs Type B.

For testing and acceptance of fixed electrical installations in accordance with: DIN VDE 0100, ÖVE E 8001, NIV/NIN 2010, BS 7671, IEC 60364. Light and compact portable device with a clear user interface, a large backlit LCD display and a data logging function with a PC download. For all fundamental installation tests including insulation resistance, loop impedance and short circuit measurement, triggering time and tripping current of RCDs/quick-acting protective devices, low-ohm measurement and rotary field testing.

#### Scope of delivery

- Set of measuring cables
- Carrying strap
- Carrying case
- Brief instruction, manual on CD
- Batteries

Order no. **8040008**

#### Software for Beha-Amprobe Telaris ProInstall-0100

Convenient, extendible software for logging measurement data per DIN VDE 0100/0105. Log design per ZVEH protocol. Includes interface adapter TL USB.

Order no. **8040009**

### 3 T110 VDE voltage and continuity tester

Ideally suited for basic training in electrical engineering, with switching load.

VDE-tested and EN 61243-3:2010-compliant, with measurement peaks per the safety regulation HSE GS 38. With its robust and ergonomic plastic housing and the thicker measuring lead with a wear indicator, T110 is ideal for mobile use. Equipped with a direction of rotation indicator for three-phase systems and functions for testing RCDs via loads which can be switched with two-button operation. Also includes a special electric flashlight function for working in dark environments.

- Voltage: 12 – 690 V
- Rotary field: 100 – 690 V
- Flow: 0 – 400 kΩ
- Frequency: 0/40 – 400 Hz
- Measuring circuit category CAT III/690 V
- Measuring circuit category CAT IV/600 V

#### Scope of delivery

- Batteries
- Brief instructions

Order no. **8040007**

### 4 Amprobe DR 705 phase sequence indicator

Simple phase sequence indicator, ideal for basic training in three-phase current engineering and drive technology.

Indicates the three phases and the phase sequence via LEDs. No battery required.

- Voltage: 120 – 400 V
- Rotary field: 200 – 440 V
- Resistance: 0.1 Ω – 40 MΩ
- Frequency: 50 – 60 Hz
- Measuring circuit category CAT III/300 V

#### Scope of delivery

- 3 probe tips
- Crocodile clamp
- Manual

Order no. **571835**



# Accessories and optional components

## Electrical engineering/Electronics



**1 Tektronix TBS1052B-EDU digital storage oscilloscope**  
Standard oscilloscope for visualising relationships during basic training in electrical engineering.

Curves can be traced and evaluated on a PC.

- Display: Coloured
- Bandwidth: 50 MHz
- Channels: 2
- Time base: 2,5 ns – 50 s/div
- Sampling rate: 1.0 GS/s
- Resolution: 8 bits
- Y deflection: 2 mV/div – 5 V/div
- Interface: USB

**Scope of delivery**

- Mains cable
- 2x TPP0051 probe
- Documentation

Order no. **571845**



**2 Tektronix TDS 2004C digital storage oscilloscope**  
User-friendly 4-channel oscilloscope with extended range of functions for basic training in electrical engineering.

- Display: Colour
- Bandwidth: 70 MHz
- Channels: 4
- Time base: 5 ns – 50 s/div
- Sampling rate: 1.0 GS/s
- Resolution: 8 bits
- Y deflection: 2 mV/div – 5 V/div
- Interface: USB

**Scope of delivery**

- Mains cable
- 4x TPP0101 probe
- OpenChoice software
- SignalExpress software
- Calibration certificate
- Manual

Order no. **571846**



**3 Amprobe AC50A digital leakage current clamp**  
This current clamp is ideally suited to measuring discharge currents (leakage currents) and differential currents (to BGV A3).

In addition to the current clamp function, this current clamp also includes the most common multimeter functions via measuring cables such as voltage measurement, resistance and continuity.

- Voltage AC: 0.1 – 400 V
- Current AC: 0.01 mA – 60 A
- Resistance: 0.1 – 400 Ω
- Frequency range: 40 Hz – 1 kHz
- Measuring circuit category CAT IV/600 V

**Scope of delivery**

- Measuring cables
- Bag
- 1.5 V battery
- Manual

Order no. **571848**



**4 Function generator**  
Signal types: Sinusoidal, square, triangular, TTL  
Frequency range: 0.1 Hz – 500 kHz  
Voltage output: DC  
Offset: -15 – +15 V  
Voltage amplitude: 0 – 30 V

Order no. **152918**

**5 Cable BNC – 4 mm**

Cable with BNC socket and 2 jack-plugs (4 mm). For use in conjunction with a function generator and oscilloscope.

Order no. **152919**

**Cable BNC – BNC**

Order no. **158357**

**T-piece BNC**

Order no. **159298**



# Accessories and optional components

## Automation technology/PLC

### 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/analogue

The digital/analogue simulation box additionally allows the simulation and display of analogue 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)
- Analogue cable, parallel:  
Order no. 529141 (e.g., SimuBox with EasyPort)
- Analogue 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, analogue

- Permissible voltage range:  
22 – 27 V DC
- Reference: GND
- 4 analogue voltage inputs:  
Range: -10 V – +10 V (max. 30 V),  
input resistance: 200 kΩ
- 4 analogue current inputs:  
Range: 0 – 20 mA (max. -4 – +24 mA),  
input voltage: max. ±30 V
- 2 analogue outputs:  
Voltage: -10 – +10 V, short-circuit-proof,  
max. ±30 V, fuse-protected,  
current: max. 20 mA

Using an analogue cable (order no. 529141), the unit can also be used as an analogue 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 plugs 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 IEEE488:

- 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 (IEEE488 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 (IEEE488)

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 AS-interface addressing device

Addressing device with LCD display for determining slave addresses and re-addressing slaves.

Order no. **18959**

### AS-interface addressing cable

Addressing cable for connecting various slaves to the addressing device.

Order no. **18960**

### 7 Empty EduTrainer® ER housing

An empty ER housing in two sizes with an aluminium blanking plate is available for installation of custom applications in an ER frame.

small **541499**

large **541179**



# Accessories and optional components

## Automation technology/PLC



**1 I/O data cable with SysLink connectors (IEEE 488) at both ends**  
 For connection of SysLink interfaces, for example an EduTrainer® PLC, with the universal connection unit, digital (Order no. 162231).

2.5 m	34031
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**2 I/O data cable with one SysLink connector as per IEEE 488 and bare cable-end sleeves**  
 For connecting EasyPort to the I/O terminals of a PLC.

2.5 m	167122
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**3 I/O data cable, crossover, with terminal socket**  
 Connects the EduTrainer® Universal of an MPS® station with EasyPort, order no. 548687. Adapter cable for the connection: any PLC with an open I/O data cable, order no. 167122, and universal connection unit, order no. 162231.

0.3 m	167197
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**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 Analogue cable, parallel**  
 EasyPort/PLC connection for a real process or a simulation box.

2 m	529141
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**6 Analogue cable, crossover**  
 EasyPort with actual PLC and/or simulation box.

2 m	533039
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**7 PC adapter**  
 Cable for the SIMATIC S7 with a USB port for Win XP/Vista/7 with 32/64 bit.

USB	539006
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**8/9 Profibus cable**  
 Connection between 2 Profibus stations.

8 0.5 m	533035
9 2.0 m	533036



**10 Ethernet cable**  
 2 m, RJ45, CAT5

2 m	567280
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**11 Safety laboratory cable, 3 m**  
 For connecting an EduTrainer® Universal without a power supply unit to an external 24 V power supply unit. 3 m long, 3 x 4 mm safety plugs (blue, red, green/yellow).

Order no.	571817
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**12 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
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**Connecting cable for solenoid valves with M8 central plug**  
 Connecting cable (4-pin plug) 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

### Components for S7-300:

#### Front-panel connector

Screwed contacts, 20-pin

Order no.	184554
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Screwed contacts, 40-pin

Order no.	660560
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Flat/round cable connector, 20-pin

Order no.	533663
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Flat/round cable connector, 40-pin

Order no.	533662
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#### Micro Memory Card

For CPU 313C, 313C-2DP, 314C-2DP, ET 200S with IM151/CPU. RAM: 64/512 KByte.

64 kByte	533030
512 kByte	536740

# Accessories and optional components

## Automation technology/PLC

### 1 DIN rail set

Two 300 mm long DIN rails, matching relay socket and terminal set, with mountings for adapter fitting to aluminium slotted profile plate.

Order no. **548637**

### Terminal strip

35 terminals, terminal block and bridges for DIN H-rail mounting.

Order no. **541158**

### 2 Cable duct set

1 x 150 mm, 3 x 265 mm and 1 x 500 mm cable ducts with mountings for adapter fitting to aluminium slotted profile plate.

Order no. **548638**

### T-head nut M5

For safe mounting of own applications, cable ducts or DIN H-rails on the aluminium slotted profile plate.

Order no. **254490**

### 3/4/5 Relay, time-delay relay

- Relay (24 V) with 3 changeover or 3 NC and 3 NO contacts for DIN H-rail mounting
- Relay, response delayed (24 V) with changeover contact for DIN H-rail mounting
- Relay, with switch-off delay (24 V), with changeover contact for DIN H-rail mounting

Relay (24 V) with 3 changeover or 3 NC and 3 NO contacts

3 Order no. **541152**

Relay, response delayed (24 V) with changeover contact

4 Order no. **541153**

Relay, with switch-off delay (24 V), with changeover contact

5 Order no. **541154**

### 6/7/8 Electrical signal input/output

For front panel mounting with bracket. For attachment on universal adapter for example (order no. 195224) or directly on perforated plate.

- Electric pushbutton (NO and NC contacts)
- Electric control switch
- LED indicator light

Electric pushbutton (NO and NC contacts)

6 Order no. **541155**

Electric control switch

7 Order no. **541156**

LED indicator light

8 Order no. **541157**

### 9 BNI IOL network interface with 8 programmable inputs/outputs

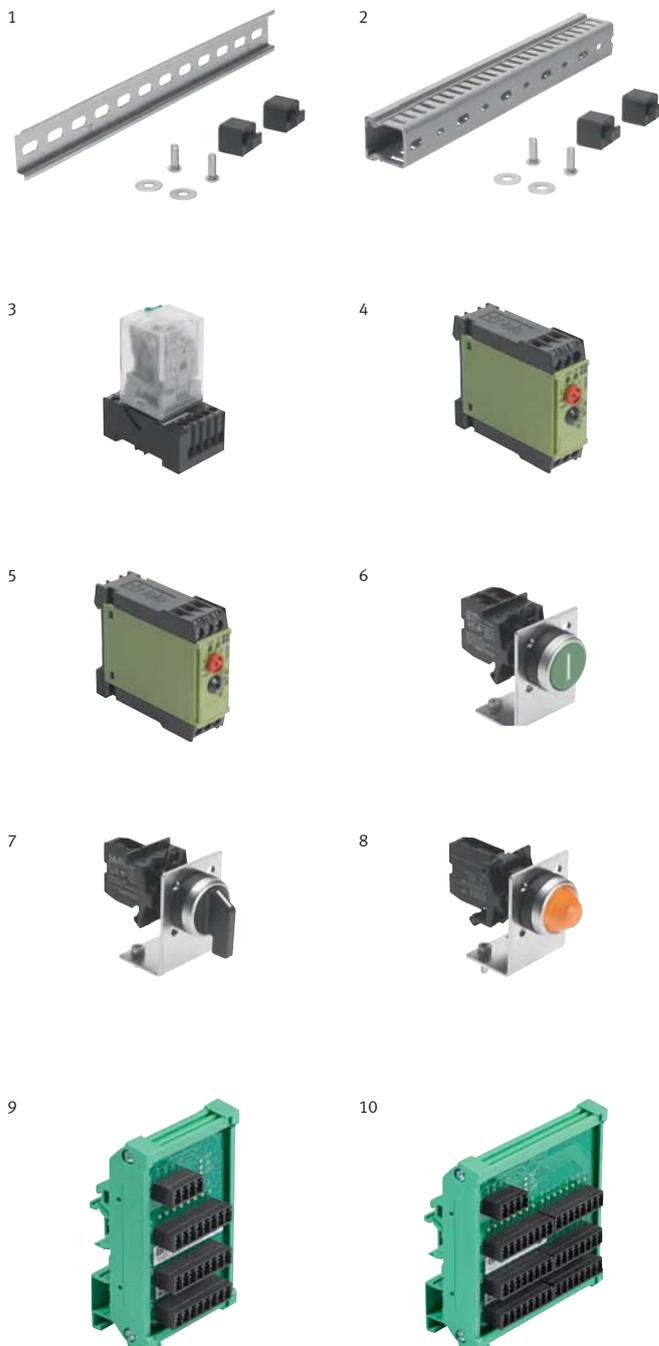
For use as a decentralised module for connecting standard binary sensors and controlling actuators. An IO-Link device communicates with the IO-Link master module via the IO-Link protocol.

Order no. **8024926**

### 10 BNI IOL network interface with 16 programmable inputs/outputs

For use as a decentralised 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**



# Accessories and optional components

## Order means



### 1/2/3/4/5 Systainer® with T-LOC system

Stackable and interlocking case system, made of light grey plastic with light blue T-LOC rotary locks, one-hand operation, for opening and interlocking the Systainers®. With four slots for credit-card-sized labels or markings.

- Size I: external 105 x 396 x 296, internal 75 x 383 x 267
- Size II: external 157.5 x 396 x 296, internal 127.5 x 383 x 267
- Size III: external 210 x 396 x 296, internal 180 x 382 x 266
- Size IV: external 315 x 396 x 296, internal 285 x 382 x 266
- Size V: external 420 x 396 x 296, internal 384 x 381 x 265

(Dimensions in mm H x W x D)

Size I	8022295
Size II	8022296
Size III	8022297
Size IV	8022298
Size V	8022299

### 6 Dolly truck for Systainer

Dolly truck for transporting T-LOC and Classic Line Systainers sizes I to V. Four guide rollers, two of which have locking brakes.

Order no.	549789
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# Accessories and optional components

## Order means

### Systainer/container inserts

Didactic components need to be stored in a clearly arranged and safe way. Simply clamp two handles onto the narrow side of the insert of your choice and stack the inserts in the Systainer. Note: Two large and one small insert exactly fill a Learnline container drawer.

#### 1 Systainer/container insert A

Dimensions (W x D): 351 x 172 mm.  
For Systainers sizes 1 – 4.

Order no. **687927**

#### 2 Systainer/container insert B

Dimensions (W x D): 351 x 264 mm.  
For Systainers sizes 1 – 4.

Order no. **687461**

#### 3 Systainer/container insert C

Dimensions (W x D): 351 x 264 mm.  
For Systainers sizes 1 – 4.

Order no. **687929**

#### 4 Systainer/container insert D

Dimensions (W x D): 351 x 264 mm.  
For Systainers sizes 1 – 4.

Order no. **689087**

#### 5 Systainer/container insert E

Dimensions (W x D): 351 x 264 mm.  
For Systainers sizes 1 – 5.

Order no. **701309**

#### 6 Systainer/container insert F

Dimensions (W x D): 351 x 264 mm.  
For Systainers sizes 1 – 5.

Order no. **709844**

#### 7 Systainer/container insert G

Dimensions (W x D): 351 x 264 mm.  
For Systainers sizes 1 – 5.

Order no. **687943**

#### 8 Systainer/container insert H

Dimensions (W x D): 351 x 264 mm.  
For Systainers sizes 1 – 5.

Order no. **687944**

#### 9 Systainer/container insert I

Dimensions (W x D): 351 x 264 mm.  
For Systainers sizes 1 – 5.

Order no. **722009**

#### 10 Systainer/container insert J

Dimensions (W x D): 351 x 264 mm.  
For Systainers sizes 1 – 5

Order no. **754668**

#### 11 Systainer/container insert K

Dimensions (W x D): 351 x 264 mm.  
For Systainers sizes 1 – 5

Order no. **754701**

#### 12 Systainer/container insert L

Dimensions (W x D): 351 x 172 mm.  
For Systainers sizes 1 – 4.

Order no. **754704**

#### 13/14/15 Handles for Systainer/ container inserts

The handles are available in three different versions, suitable for Systainer sizes 2 – 5:

- Handle 80: 80 mm high version
- Handle 100: 100 mm high version
- Handle 150: 150 mm high version

When stacking the inserts in the Systainer the handle height determines the distance between the stacked inserts. The handles can be used for all Systainer/container inserts. Two handles are required per insert.

13 Handle 80 **683012**

14 Handle 100 **687455**

15 Handle 150 **683464**







**Mobile robot platform for research and training.....260**

# Robotino®

## New potential at all levels



### Mobile robot platform for research and training

With its omnidirectional drive, sensors, interfaces and application-specific extensions, Robotino® is equipped for universal use.

The most important programming languages and systems are available for programming individual applications.



### Mobile robotics and service robotics

Just as industrial robots, mobile and service robots are also becoming more and more important. In keeping with this technical and economic trend, the new Robotino® forms the basis for research and training in these applications.

### Extremely powerful:

#### The new computer performance

With scalable computer performance for autonomous control, image processing and the evaluation of data from laser scanners.

### More interfaces than ever before

More convenient, faster, more diverse: new, state-of-the-art functions ensure greatest possible system expandability.

### Open source concept

Full access to the entire source code for the implementation of robot applications with common programming languages and systems.



**Fit for research:  
With the Robotino® for  
Industry 4.0**

With its new, flexible operating height, Robotino® has been fully integrated into the world of MPS® systems and research factories as an autonomous transport system.

Once programmed, Robotino® automatically identifies, for example, the correct MPS® station – the first step towards a fully automated production system!



**Sturdy and movable**

With three independently driven omniwheels, Robotino® can move in all directions. The stainless steel structures of the frame ensure high stability in every travel situation.



**Payload greater  
than unladen weight**

Thanks to its sturdy design, Robotino® can move a payload of up to 30 kg while weighing 20 kg itself.



**Flexible and adaptable design**

Numerous mounting choices and the optional mounting tower with individually positionable platforms ensure that Robotino® can be used for a wide variety of tasks.



**Plug and play**

Robotino® supports various grippers, manipulators and sensors through plug and play. Robotino® recognises these components once they are connected, and the control can begin.

# Robotino®

## For research and education: Premium Edition and Basic Edition



### Select your version!

Robotino® is available in two standard versions, **Premium Edition** and **Basic Edition**. These two versions differ in computing power, the size of the internal memory and the mechanical extension, the mounting tower.

### Omnidirectional drive

The three drive modules of the Robotino® are integrated in a stable, laser-welded stainless steel frame. With its omnidirectional drive, Robotino® moves quick as a flash 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.

### Everything in view

The frame contains nine infrared distance sensors. An analogue inductive sensor and two optical sensors are additionally available, enabling the Robotino® to recognize and follow predefined paths. Robotino® is supplied with a colour camera with full HD 1080p resolution.

### Uninterrupted use

Power is supplied via two 12 V non-spillable lead-gel rechargeable batteries which permit a running time of up to four hours. The system is automatically switched off in time if the state of charge is too low. A power supply unit and a jack are included in the scope of delivery, which means that Robotino® can also be used for experiments or further development of control programs while it's charging.

Premium Edition	8029256
Basic Edition	8029346

Included in scope of delivery:

#### Mobile robot system

- Diameter: 450 mm, height incl. controller housing: 290 mm
- Total weight: approx. 20 kg (without mounting tower), payload: max. 30 kg
- Circular stainless steel frame with omnidirectional drive
- Rubber protection strip with built-in collision-protection sensor
- 9x infrared distance sensors, 1x inductive sensor, 2x optical sensors
- Colour camera with full HD 1080p resolution and USB interface
- **Premium Edition:** mounting tower with three mounting platforms

#### Control and interfaces

- Embedded PC to COM Express specification
- **Premium Edition:** Intel i5, 2.4 GHz, dual core, 8 GB RAM, 64 GB SSD
- **Basic Edition:** Intel Atom, 1.8 GHz, dual core, 4 GB RAM, 32 GB SSD
- WLAN to specification 802.11g/802.11b as client or access point
- Motor control with 32-bit microcontroller and free motor connection
- 2x Ethernet, 6x USB 2.0 (HighSpeed), 2x PCI Express slots, 1x VGA
- 1x I/O interface for integrating additional electrical components

#### Software

- Graphical programming environment for external PC that runs on Windows XP, Vista, Windows 7/8
- API for programming with C/C++, JAVA, .Net, LabVIEW, MATLAB/Simulink, ROS SmartSoft and Microsoft Robotics Developer Studio

#### Control

At the heart of Robotino® is an embedded PC to the COM Express specification. This is how the scalability of the computing power is achieved. In the two standard versions of Robotino®, an Intel Core i5 processor with 2.4 GHz or an Intel Atom processor with 1.8 GHz is used. The embedded PC can be exchanged at any time. The operating system and all user data are stored on a solid state disk (SSD) with 64 GB or 32 GB.

A 32-bit microcontroller that directly generates the PWM signals for actuating up to four electric DC motors is responsible for the motor control. An FPGA is used to read in the encoder values of the motors. This enables, for example, the odometer data and any additional sensor-specific correction data to be calculated directly in the microcontroller.

#### Expandability

Additional components can be connected to the robot controller via standard interfaces such as USB 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 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. The Premium Edition already contains the optional mounting tower for Robotino®. The mounting column of the tower offers various options for fastening mounting platforms for manipulators or sensors at different heights.



#### Robotino® Basic Edition

The variant for use in technical basic and further training with less computing power, less memory and without a mounting tower.



Also order:

#### Robotino® Workbook

Campus licence (→ Page 53):

de	8029494
en	8029495
es	8029496
fr	8029497

#### Recommended training media

- Robotino® SIM Professional
  - Robotino® SIM
- Page 267

#### Graphical programming

Robotino® View is the interactive, graphical programming and learning environment for Robotino®. It communicates directly with the robot system via wireless LAN. The programming system combines state-of-the-art operating concepts, expandability by the user and intuitive operation. After the program has been developed, it can be loaded into the controller of Robotino® in order to enable completely autonomous operation.

#### First steps with simulation

As an add-on, you can use an attractive 3D simulation package (Robotino® SIM), which simulates the Robotino®'s travel behaviour and sensors in an appropriate working environment. This allows you to test your programs in the simulation first.

#### Open programming environment

The programming interface (API) of Robotino® allows various programming languages and systems to be used to develop a control program. The API supports the following languages and systems:

- C/C++, JAVA, .Net
- LabVIEW and MATLAB/Simulink
- Robot Operating System (ROS SmartSoft)
- Microsoft Robotics Developer Studio

#### Hardware-in-the-loop scenario

If you create your own motor controller, e.g. in MATLAB, the motors of Robotino® can be controlled with this software controller via the Ethernet interface.

#### Microcontroller programming

The 32-bit microcontroller is externally accessible and can be used directly for programming custom applications.

## WLAN access point



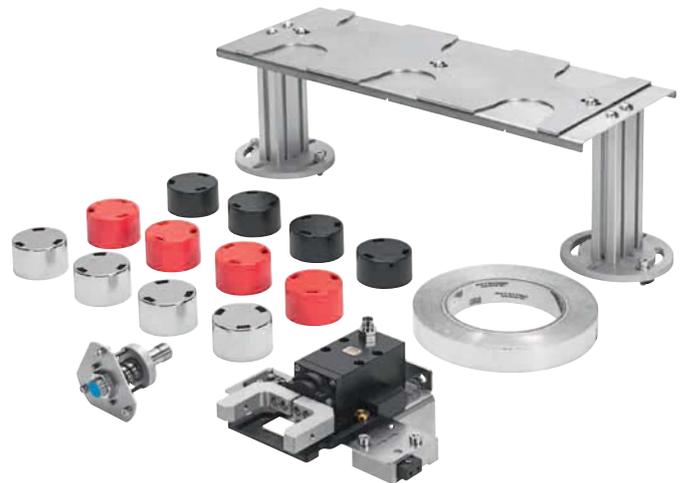
This external access point supports the W-LAN standard IEEE 802.11g with a transmission rate of up to 54 Mbps.

The external access point enables you to connect multiple Robotinos® to an Ethernet PC network without any problems. To do this, the Robotinos® only need to be switched to client mode. The Allnet access point is preprogrammed for you, and will automatically start communication with the Robotinos®. To secure the wireless network externally, WEP/WPA encryption and MAC address filters are implemented.

### Scope of delivery

- Access point
- Programmed with “Robotino® APX.1”
- USB power cable and Ethernet cable

## Logistics Kit



The Logistics Kit consists of an electric gripper, flat storage area with 2 rows, an inductive sensor and a set of workpieces.

The **electric gripper** is completely integrated in the Robotino® platform, so that while it is moving, monitoring is not necessary for potential collisions with the gripper. The gripper detects workpieces between the gripper jaws by means of an integrated through-beam sensor. To pick up a workpiece from a bearing surface, a slide is integrated, which signals the optimal position for the gripping process to the Robotino®. The gripper end positions are checked via the motor current evaluation.

The gripper function is available as a functional module in Robotino® View (starting from Version 1.7).

### Scope of delivery

- **Electric gripper**  
Gripper stroke: 4 mm  
Maximum workpiece diameter: 40 mm  
Maximum workpiece weight: 300 g  
Gripping force: 140 N  
Closing/opening time: 2 s  
Operating voltage: 24 V DC  
Maximum current: 140 mA
- **Analogue inductive sensor** for mounting in the middle of the robot frame
- **Flat storage area** with 2 rows and 3 storage places per row for cylinder-shaped workpieces with a maximum diameter of 40 mm.
- **Workpiece set**
- **Aluminium adhesive tape** for marking the access routes to the storage area, which the Robotino® can align itself on for gripping the workpieces.

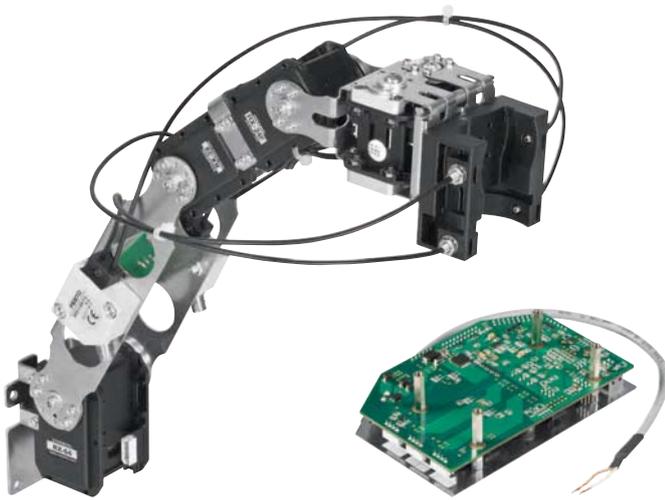
Robotino from 2014	8029450
Robotino until 2013	564179

The most important components at a glance:

Electric gripper, Robotino from 2014	8029451
Electric gripper, Robotino until 2013	564176
Inductive sensor, analogue, Robotino from 2014	8029483
Inductive sensor, analogue, Robotino until 2013	564177
Flat storage	564178
Workpiece set “Cylinder bodies”	167021
Aluminium tape	564213

Order no. **567228**

## Electric gripper arm



The electric gripper arm for Robotino® is a triple-axis gripper arm with servo motors that is installed in the loading bay of the Robotino®. The control board supplied is connected to the power supply (24 V) of the I/O interface and the arm movement controller via the USB interface. The handling weight is limited to 200 g and the gripper stroke is 30 to 60 mm. The unit can grip workpieces in two places. The gripper jaws are fitted with opto-electrical sensors to detect when a workpiece is present.

The gripper jaws supplied allow handling of MPS® workpieces. Robotino® View supports manipulator programming with a list of positions and function blocks for reading and writing axial values. In addition, Robotino® SIM Professional contains a simulation model of the electric gripper arm for Robotino®. The manipulator can also be controlled via the Open-Robotina API.

Overview of key technical details:

- Load bearing capacity up to 200 g
- Gripper stroke 30 – 60 mm
- Two gripping positions
- Opto-electrical sensors for detecting presence at the gripping positions
- Controlled servo motors
- 24 V DC power supply
- USB connection

## Forklift



With the easy to use forklift, the Robotino® operates, for example, as a driverless transport system in a production environment.

Assembly is done in the loading bay of the Robotino® with the assembly material included in the scope of the delivery. The electrical interface of the forklift is possible using the existing additional motor control. Here, the voltage supply and the increment generator are directly connected to the motor plate.

Programme the function of the forklift in the Robotino® view or via the OpenRobotino® programming interface. In Robotino® view you can set the axial speed from -100% to 100% using the “Power output” module component and read the axial position and speed of the linear axis using the “Speed sensor input” module component.

Basic principles and details of the automated logistics can be determined with this extension to the range of applications.

**Technical data**

- Load bearing capacity up to 4 kg
- Maximum stroke 160 mm
- 2 proximity sensors for end-position monitoring
- 1 diffuse sensor for pallet control
- 2 self-centring pallets (included in scope of delivery)
- Connection via motor controls and encoder input
- Compatible with control board EA09

Robotino from 2014	8029452
Robotino until 2013	574147

Robotino from 2014	8029453
Robotino until 2013	576300

## Laser scanner



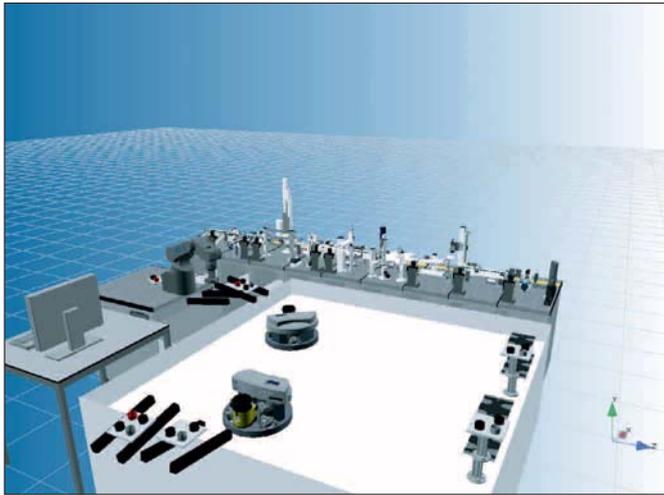
The laser scanner for Robotino® allows the creation of maps, localisation and navigation, as well as obstacle recognition, thanks to the digital detection of objects on one plane. In order to prevent collisions, the 2D laser scanner Hokuyo URG-04LX-UG01 can be mounted above the controller, for an all-round view, or in the loading bay of the Robotino®. The scanner is connected to the control unit and supplied with power via a USB connection.

The laser scanner is fully integrated into the Robotino® software architecture. The laser scanner's measured values can be accessed by both Robotino® View and self-developed control programs.

Overview of key technical details:

- Measuring range 20 – 5600 mm
- Angle range 240°
- Resolution 1 mm
- Precision  $\pm 30$  mm or  $\pm 3\%$  at 1000 mm or greater distance from an object
- Scanning frequency 10 Hz
- Power consumption 2.4 W
- Weight 160 g
- USB connection

## Robotino® SIM Professional



Robotino® SIM Professional is an ideal virtual learning environment for working with Robotino®. Identifying differences based on actual behaviour is the key to grasping, analysing 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 analogue 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®.

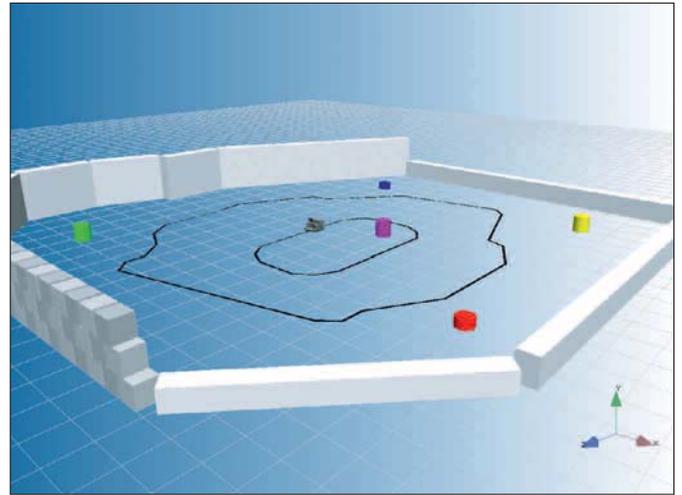
Robotino® can be programmed using Robotino® View or in one of the high-level languages C, C++, C# or Java. To do this, you require the corresponding API interface.

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

## Robotino® SIM



Robotino® SIM is a Windows software program for the 3D simulation of Robotino® in an exciting, predefined virtual experimentation environment.

The Robotino® simulation model cannot be extended, and includes the geometric model with the three omnidirectional drive wheels, a camera, nine distance sensors and the digital sensor in the chassis protection strip.

You can program Robotino® free of charge using Robotino® View or using one of the high-level languages such as C++ or Java.

The latest version of Robotino® SIM is now available to download free of charge.

# 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.



1



2



3



4



5



6

## A flexible and adaptable design

Remove covers (1)

Fasten mounting column (2)

Fix mounting platform at any level (3)

Connect, align and mount laser scanner and camera (4)

Attach platform with electric gripper and connect gripper (5)

Connect and fasten signal column (6)

## Robotino® project ideas

The modular structure, attachment devices and open software interfaces make Robotino® the ideal platform for project work.

With Robotino®, we provide the platform – now nothing stands in the way of developing exciting extensions. This is how fascinating projects are created. A few of them are described here. More detailed information can be found at [www.robotino.de](http://www.robotino.de)

The advantage for you:

- Reliable design – stable frame: no investment in mechanical maintenance
- Operating system based on Linux or Windows – for software reliability
- Powerful drive unit and high-quality omnidrive – concentrating on an intelligent solution for the project task

Technical defects, non-reproducible effects and undesired project delays are therefore a thing of the past.

Would you also like to implement projects with Robotino®?  
E-mail: [did@de.festo.com](mailto:did@de.festo.com).

### ProLog factory

The ProLog Factory provides an outstanding new training platform for logistics. The material flow is implemented using Robotino® mobile robot systems, which also have an integrated lifting arm to pick up and deposit pallets at different stations for a specific job → Pages 354 – 357.



### European champion!

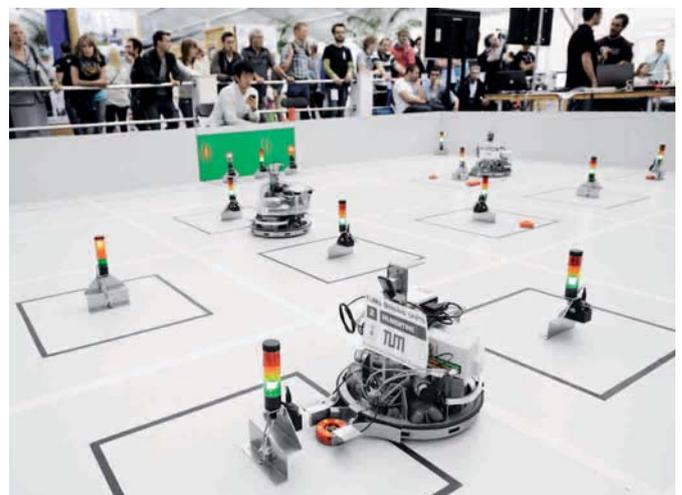
Robotino® is the official competition equipment for the WorldSkills international competition. In the national preliminary rounds as well as the international championships, the participants of the competition use Robotino® mobile robotics as an autonomous transport system or as a service robot, for example.



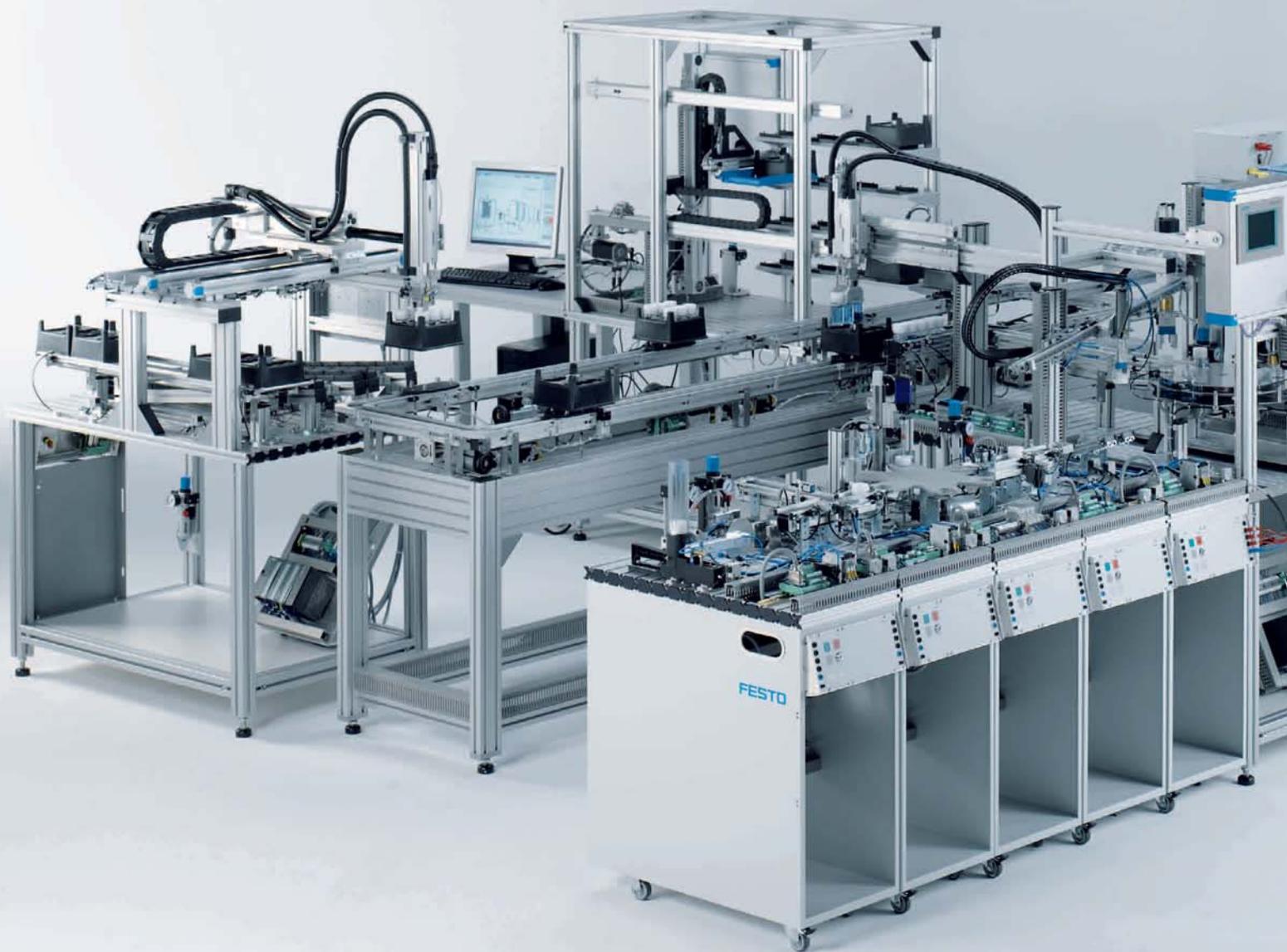
### Fit for research:

#### RoboCup Logistics League

Researchers from all over the world compete against each other in the RoboCup Logistics League, in which Robotino® takes on the task of an autonomously operating driverless transport system. As from 2014, the new Robotino® is also permitted in the RoboCup.



## Mechatronics and factory automation





**MPS® – The modular production system**

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# MPS® – The modular production system

## From module to learning factory



### Practical at every level

The modular production system MPS® sets the right challenges and provides appropriate learning environments for various requirements:

- Differentiated functions
- Individual and combined units
- Different drive technologies
- Material and information flow
- Modern and variable control concepts

### Modular variety

The MPS® transfer system fits in a cabinet but can also be combined to create networked production lines.

The MPS® stations are supplied with trolleys, provide space for the control system, are fully assembled and can be a basis for complex learning factories.



### MPS® transfer system

The ideal system for anyone focused on process and automation:

- One line, various drives, numerous modules and functions with state of the art technology
- Transportable, designed for cabinets, individually and combined in different layouts
- Defined interfaces enable individual modules to be viewed and quickly changed to rapidly adapt to the required learning content.



### MPS® stations

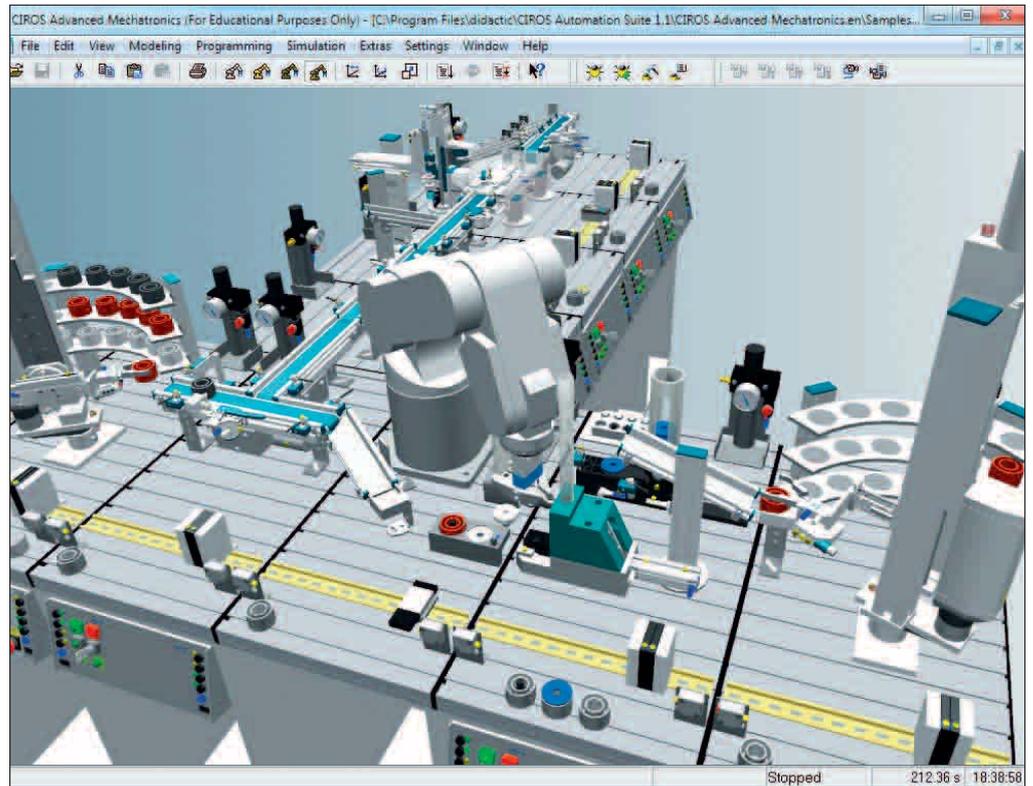
The system for anyone who values industrial basic and advanced training, mechatronics and automation, value retention and robustness of the equipment:

- Since 1991, the system for the mechatronics world championships
- Stations represent the most common sub-processes in any automated production system
- Platform for problem based practical training
- Maximum industrial relevance in automation and handling technology

**Real and virtual**

The MPS® is not only the platform for training with maximum transfer to industrial practice. It also provides unique flexibility for choosing the appropriate methods:

- All MPS® stations and systems are identical to the models in the CIROS® process simulation
- PLC training and troubleshooting can be provided using the real model and the 3D models in CIROS®



**MPS® 500-FMS**

- Once you have mastered the sub-processes in the MPS® stations, you can use the MPS® 500 FMS to focus on thinking and operating in networked systems.
- The belt rotation system and bus concept allow variable system concepts
  - Sub-processes on the one hand and the overall system on the other provide project tasks and challenges for working in a team
  - All FMS systems are guaranteed ready to use when delivered



**MPS® 200 complete system**

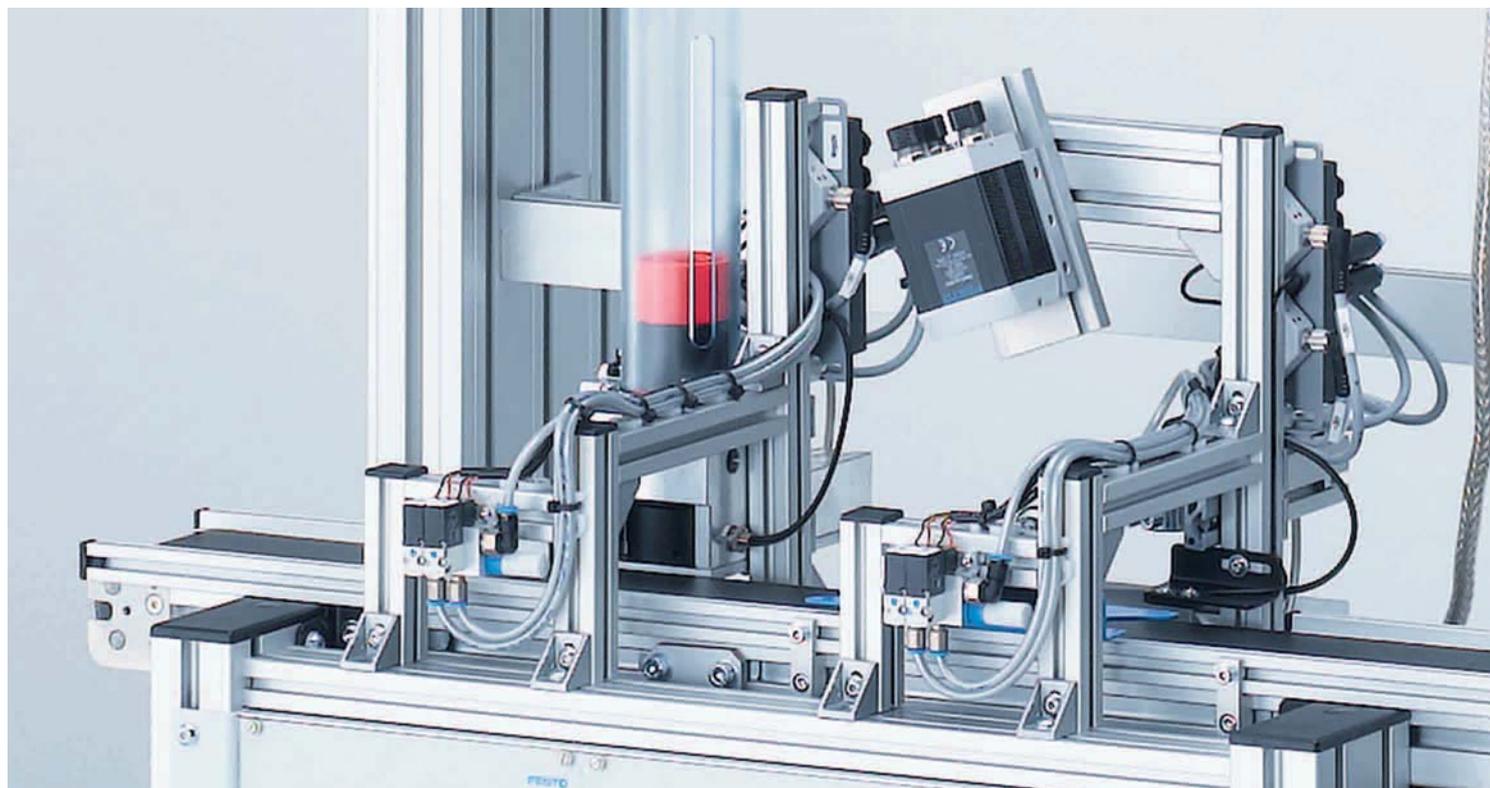
- Combining stations into systems for selected areas and complexity levels:
- Topic-specific complete solutions including control system, networking, application and learning software
  - For process-oriented, cross-technology courses at schools and technical schools
  - Ready to use immediately and expandable
  - Versions for small and large budgets



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

## MPS® Transfer system

Get moving with mechatronics and electronics training



### Keeping training moving

The MPS® transfer system has been developed for everyone who wants to make headway with training, be it for the electrical or metal trades or for training technicians and engineers in mechatronics.

The key features of the MPS® transfer system are its innovative technology and the consistent use of industrial components.



### Transfer line

The transfer line is made of solid profiles and can be used to transport workpieces or workpiece holders. Top quality, flexible, well thought-out and modular, it is the basis for numerous successful projects.



### Drive concept

DC motor, AC motor, servo motor or stepper motor – the belt can be combined with all motor types with just a few simple actions. Professional clutches and toothed belt gearing simulate practical industrial applications while providing optimum training flexibility.



### Modules

The individual modules are complete automated units that can easily be integrated into a single transfer line. The MPS® transfer system focuses on topics such as sensors, electrical positioning, handling, assembly, camera inspection, barcode scanning, RFID and many more, making it an ideal platform for forward-looking projects.



**Multimedia support**

Digital training programs for specific topics relating to the MPS® transfer system facilitate effective training, including the very latest trends in automation technology. The Machine Vision training program provides the perfect introduction to modern industrial image processing.

**Just as in industry**

Belts play a crucial role in automated production. Products are transported using belts of different widths or even double belts. On the MPS® transfer system, material is transported on a standard industrial belt.



**Control**

The transfer system is compatible with microcontrollers such as the LOGO! or more complex control systems with a wide variety of configurations. We can produce the ideal control system for you, tailored to your needs.



**Networking like the professionals**

All modules are available with both I/O wiring and a range of bus connections.

**Ready to go with:**

- I/O
- AS-interface
- CANopen
- Profibus DP
- Profinet



**Workstation**

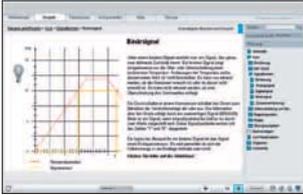
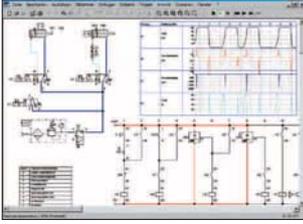
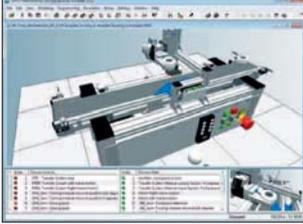
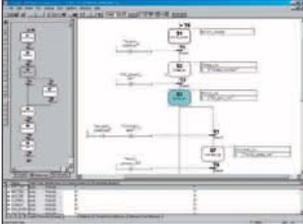
A range of laboratory equipment and a trolley specially tailored to the MPS® transfer system creates the optimum working environment for you.



**Experience**

Several kilometres of our transfer solutions are already providing a reliable material flow in the AFB, iCIM, MPS® 500 and iFactory training factories for our customers and partners worldwide. This guarantees a well thought-out concept with a high quality design to strict industrial standards.

# Control and configure

The choice is yours	Components	Configuration and programming	Advantages
<p><b>Testing and commissioning with the simulation box</b></p>			<ul style="list-style-type: none"> <li>- Easy commissioning of MPS® transfer line</li> <li>- Testing and commissioning for modules</li> </ul>
<p><b>Control with EasyPort</b></p>			<ul style="list-style-type: none"> <li>- Control the MPS® transfer line from a PC</li> <li>- Implement simple relay or logistic controllers with FluidSIM®</li> <li>- Control the MPS® transfer line with PLCSIM</li> </ul>
<p><b>Simulation</b></p>			<ul style="list-style-type: none"> <li>- The comprehensive model library of CIROS® contains 3D process models of selected MPS® transfer system modules.</li> <li>- The models can be controlled straightaway with the integrated virtual S7-PLC.</li> <li>- The powerful error simulation contains various error scenarios including adjustment errors for sensors.</li> </ul>
<p><b>Programming</b></p>			<ul style="list-style-type: none"> <li>- Programming using controllers and networking components from market leaders Festo, Siemens, Rockwell and Mitsubishi</li> </ul>

**We produce the ideal controller for you:**

Configure your EduTrainer® PLC to meet your needs → Pages 208 – 221

# System overview

MPS® transfer lines can be flexibly combined and used in a variety of different ways:

### In sequence

Simply connecting transfer lines in sequence provides combinations of different sizes.



### With MPS®

The MPS® transfer lines can also be combined with the MPS® modular production stations from Festo Didactic without the need for additional components. This results in an unmatched variety of systems.



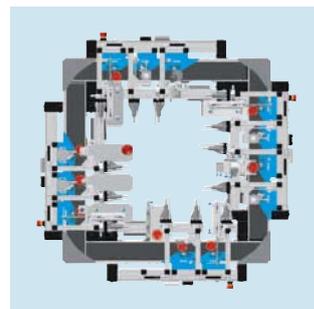
### Directly on the belt – or with workpiece holders

With the MPS® transfer system, both options are possible: workpieces can either be transported directly on the belt or on pallets, with or without an ID system.



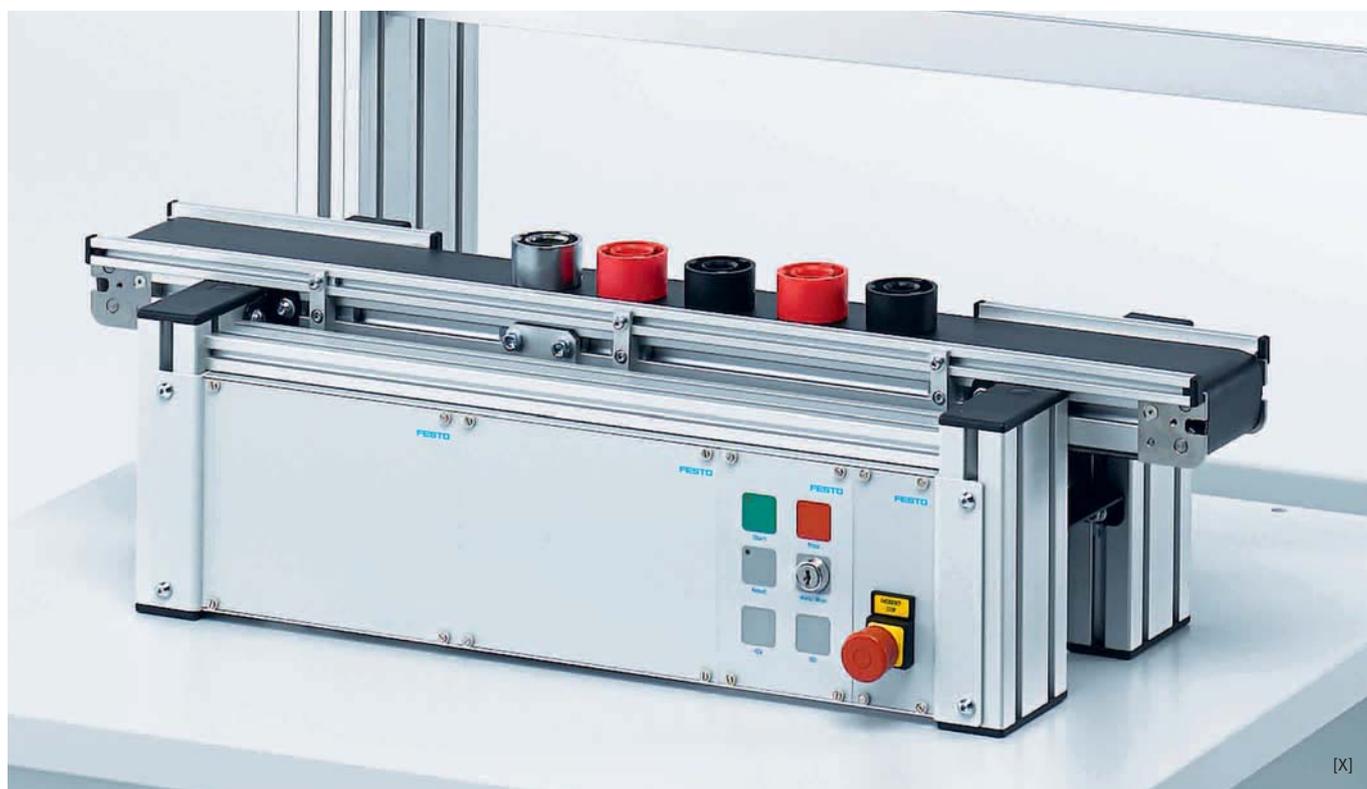
### 90° connection

Transfer lines can be combined “around corners” without additional modules. This enables complete loops to be achieved with just four lines.



# Transfer line

## Combine and expand



### Design and function

The transfer line is the basic component of the MPS® transfer system. It is made up of a belt, drive, controls and sensors and comes fully assembled. The transfer line can be used to transport workpieces or work-piece holders. The transfer line can be fitted with up to two mechatronic modules.

### Modular expansion

The transfer line can easily be expanded with different motors, controllers, inverters, control units and connection technologies such as AS-interface or I/O technology. Each line can be supplemented with a wide range of modules. However, even in “stand alone” mode, the transfer line can cover various important topics in automation technology:

- Familiarisation with different drive types
- Use of sensors
- Experimenting with relay and reversing contactors and logic circuits
- Parameterisation and commissioning of various drive controllers



MPS transfer line MT DC	C93100
MPS transfer line MT DC AS interface	C93101
MPS transfer line MT AC	C93102
MPS transfer line MT AC400	C93104

Accessories, also order:

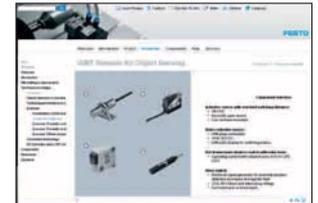
“Cylinder bodies” workpiece set	C94407
EduTrainer Universal A4 rack with SIMATIC S7-313C	567098
Sinamics G120 EduTrainer → Page 194	
Micromaster 420 EduTrainer	573868
Cable set to connect MM420 to transfer line	C94419
MPS Transfer System Frequency Converter MM420: Workbook → Page 72	

**Scope of delivery**

- MPS® transfer line MT DC:
- DC motor
  - Control panel
  - Four-quadrant drive controller
  - Optical sensors at beginning and end of belt
- MPS® transfer line MT DC AS-interface:
- DC motor
  - AS-interface control panel
  - AS-interface drive controller
  - Optical sensors at beginning and end of belt
- MPS® transfer line MT AC:
- AC motor
  - Control panel
  - Optical sensors at beginning and end of belt
- MPS® transfer line MT AC400:
- AC motor for star-delta circuit
  - Control panel
  - Optical sensors at beginning and end of belt

**Recommended learning media**

- WBT Sensor technology 2 – Sensors for object detection



- WBT LOGO! Training
- WBT Actuators – DC motor
- WBT Safety engineering
- WBT Machine Vision
- Mechatronics Assistant

Other configurations and components on request.



**Individual equipment**

We equip the 19” frame with various operation and control components based on your preferences. Expansions and additions are possible at any time.



**Intelligent connection technology**

The design of the system connections enables all additional modules to be easily connected to the transfer line. We also provide additional free terminals for your own projects.



**Clockwise or anticlockwise rotation**

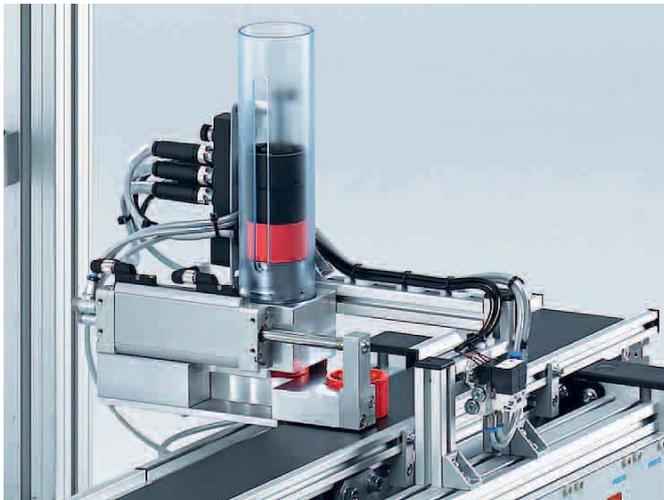
The four-quadrant drive controller allows both. The controller is actuated directly using I/Os or the AS-interface. The buttons on the controller enable the connected drive to be controlled manually during commissioning, maintenance or diagnostics.



**Variable sensors**

The sensors at the beginning and end of the belt take the form of fibre optic through-beam sensors. The mounts for the fibre optics can easily be fixed to the belt profile and adjusted depending on the application. A variety of different sensors can also be added.

# Transfer line Modules



### Stacking magazine module

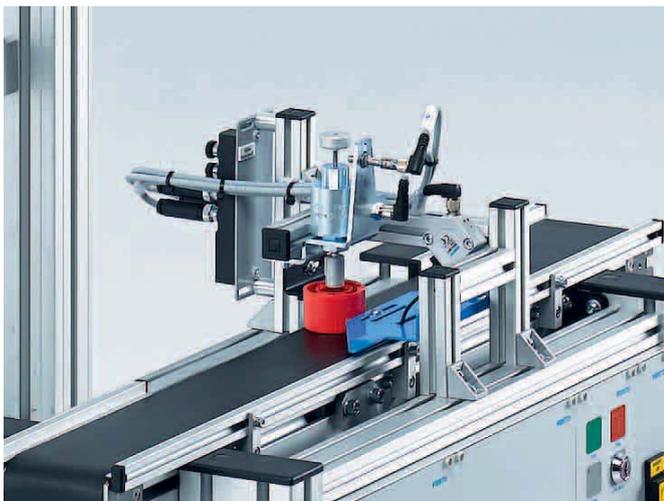
The module separates workpieces from a magazine.

The module is completely assembled with a pneumatic cylinder with end-position sensors, a retro-reflective sensor for magazine level monitoring, valve terminal and electrical connection block.

Complete with connecting cable.

Transfer line and workpieces are not included.

Stacking magazine, I/O	C93200
Stacking magazine, AS-Interface	C93201
Stacking magazine, Profibus-DP	C93202



### Drill hole monitoring module

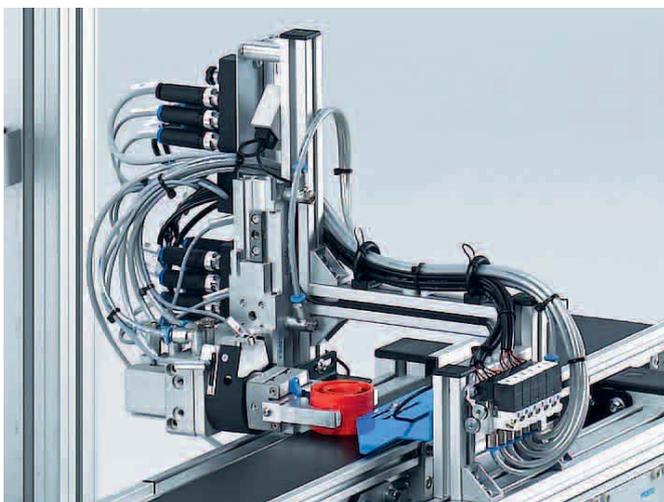
The module monitors whether there is a drill hole in workpieces. To do this, a test pin is inserted into the workpiece (with a solenoid). An inductive proximity sensor monitors if the test pin has reached its end position.

The module is completely assembled with a connection block.

Complete with connecting cable.

Transfer line and workpieces are not included.

Drill hole monitoring, I/O	C93203
Drill hole monitoring, AS-Interface	C93204
Drill hole monitoring, Profibus-DP	C93205



### Turning module

The module turns workpieces. The workpieces on the conveyor belt are detected by an optical diffuse sensor. A linear slide, swivel cylinder and linear gripper are used in the module.

The module is completely assembled with a valve terminal and two electrical connection blocks.

Complete with connecting cable.

Transfer line and workpieces are not included.

**Also order:**  
MPS® Transfer System Turning Module: Workbook → Page 72

Turning, I/O	C93206
Turning, AS-Interface	C93207
Turning, Profibus-DP	C93208

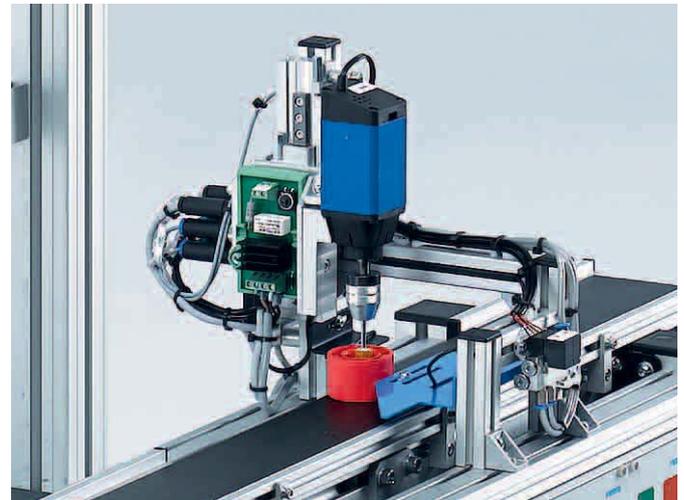
### Drilling module

The module drills workpieces (symbolically). The workpieces on the conveyor belt are detected by an optical diffuse sensor. The drilling machine is moved by a pneumatic linear slide.

The module is completely assembled with a valve terminal and an electrical connection block.

Complete with connecting cable.

Transfer line and workpieces are not included.



Drilling, I/O	C93209
Drilling, AS-Interface	C93210
Drilling, Profibus-DP	C93211

### Measuring module, analogue

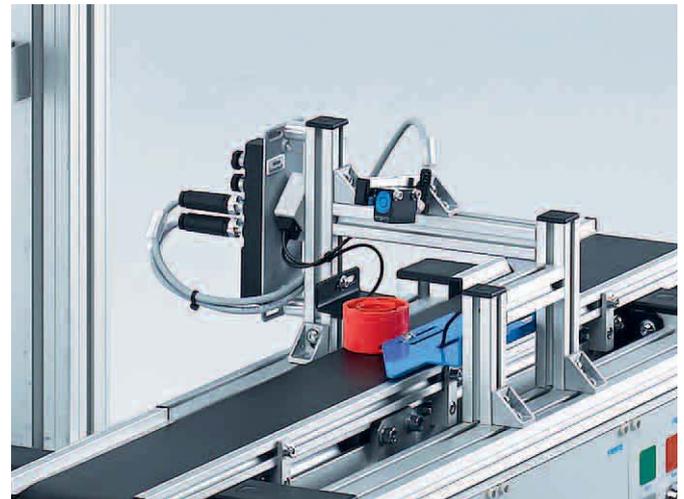
The module checks the height of workpieces. The workpieces on the conveyor belt are detected by an optical diffuse sensor. An analogue laser distance sensor is mounted above the workpiece. The measuring range of the sensor is 0 – 30 mm with 0 – 10 V analogue output and 2 PNP switching outputs. The switching outputs can be freely configured using the teach-in function.

The module is completely assembled with an electrical connection block.

Complete with connecting cable.

Transfer line and workpieces are not included.

**Also order:**  
MPS® Transfer System Measuring Module, analogue: Workbook  
→ Page 72



Measuring, analogue, I/O	C93212
Measuring, analogue, AS-Interface	C93213
Measuring, analogue, Profibus-DP	C93214

### Ejection module, pneumatic

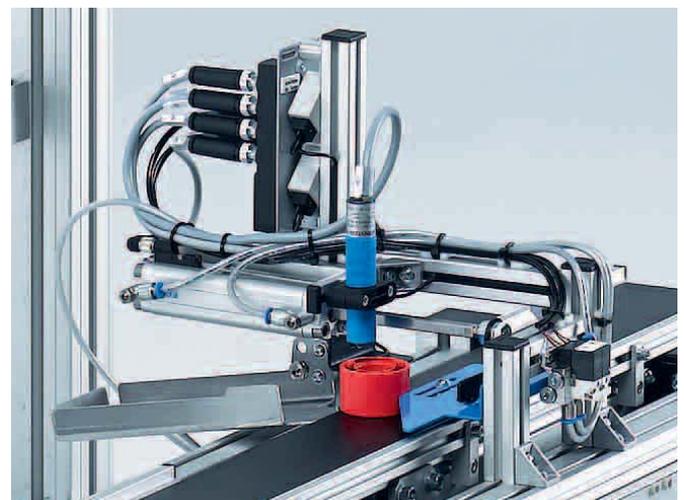
The module sorts workpieces onto a slide. The workpieces on the conveyor belt are detected by an optical diffuse sensor. A second sensor (capacitive) above the workpiece detects if the workpiece needs to be sorted onto the slide. Sorting is carried out using a slide gate, which is actuated by a pneumatic linear cylinder.

The module is completely assembled with a valve terminal and an electrical connection block.

Complete with connecting cable.

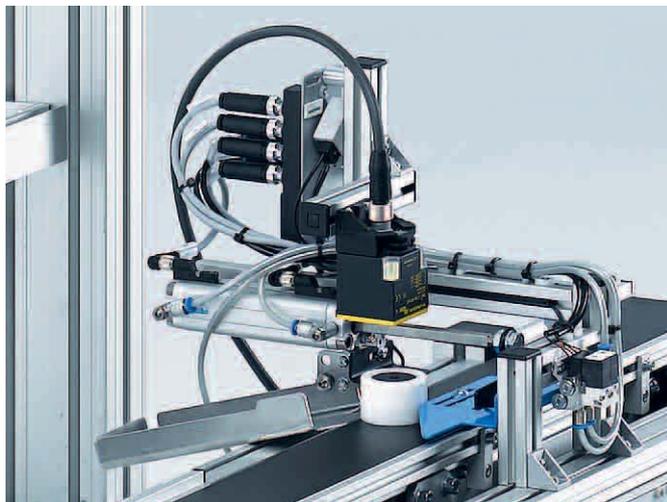
Transfer line and workpieces are not included.

**Also order:**  
MPS® Transfer System Ejection Module, pneumatic: Workbook  
→ Page 72



Ejection, pneumatic, I/O	C93221
Ejection, pneumatic, AS-Interface	C93222
Ejection, pneumatic, Profibus-DP	C93223

# Transfer line Modules



### RFID module

The module sorts workpieces onto a slide. The workpieces on the conveyor belt are detected by an optical diffuse sensor. A read-write head is used to read and check the data from the RFID chip on the workpiece. New data, based on various criteria, can be ascribed to the workpieces, which are then sorted onto the slide or transported further on the belt. Sorting is carried out using slide gate, which is actuated by a pneumatic linear cylinder.

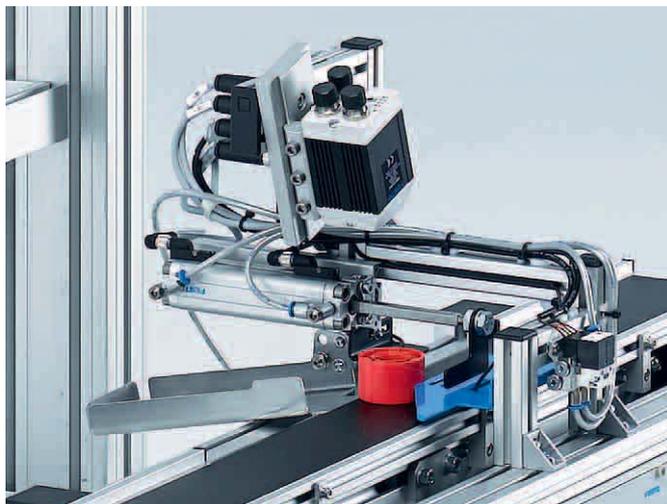
The module is completely assembled with a valve terminal and an electrical connection block.

Complete with connecting cable and Profibus DP interface for the RFID element.

Transfer line and workpieces are not included.

RFID, Profibus-DP

C93224



### Inspection camera module

The module sorts workpieces onto a slide. An intelligent colour camera with integrated lighting detects the workpieces on the conveyor belt and sorts them onto the slide depending on various criteria. Sorting is carried out using a slide gate, which is actuated by a pneumatic linear cylinder.

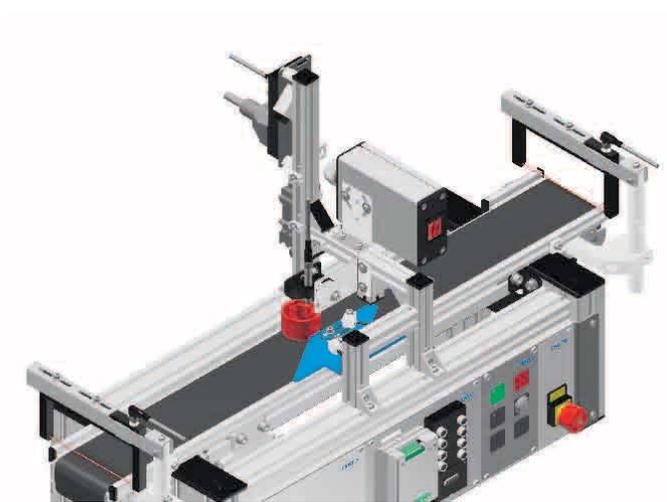
The module is completely assembled with a valve terminal and an electrical connection block.

Complete with connecting cable, intelligent colour camera system and image processing software.

Transfer line and workpieces are not included.

Inspection camera

C93225



### Detection module

The module checks the workpiece properties. The workpieces are detected on the conveyor belt by an optical diffuse sensor. Three additional sensors (optical, inductive) are attached above the workpiece in order to detect the workpiece properties. The evaluation of the workpiece information can be displayed via a segment display.

Control topics:

- Linking of information
- Coding of information
- BCD coding
- Control of a segment display

Transfer line and workpieces are not included in the scope of delivery.

Detection

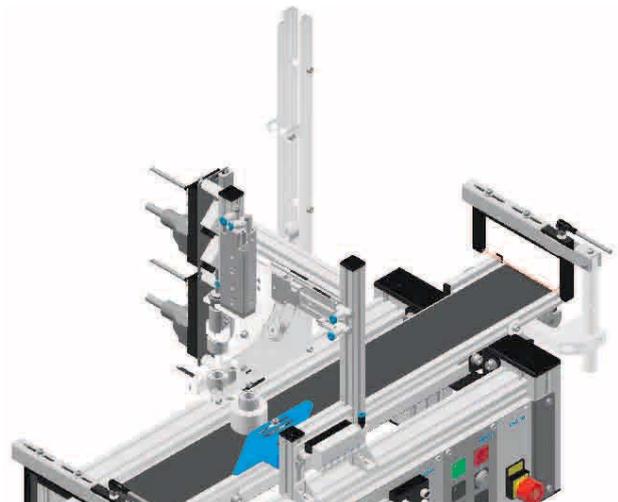
C93257

### Insertion module

The module consists of a pneumatic 2-axis handling system and inserts round metal materials into the main body. For this purpose, the handling device is equipped with a pneumatic gripper. The workpieces are detected on the conveyor belt by an optical diffuse sensor. In addition, the module is equipped with end-position switches on the linear slides and a pressure switch.

The module is completely assembled with valve terminal and connection block.

Transfer line and workpieces are not included in the scope of delivery.



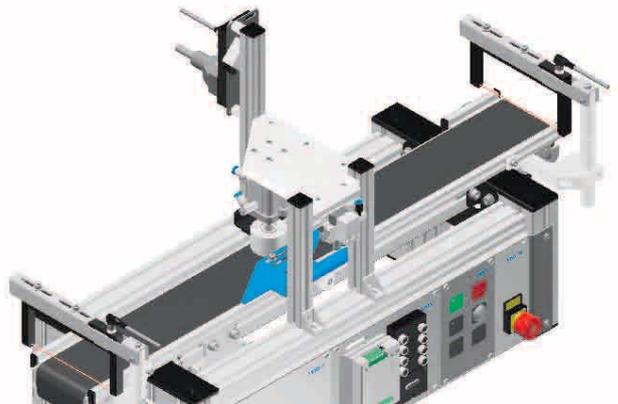
Insertion, I/O	C93263
Insertion, Profibus-DP	C93265
Insertion, Profinet	C93269

### Press-fitting module

The press-fitting module consists of a pneumatic cylinder that presses in the materials used. The workpieces are detected on the conveyor belt by an optical diffuse sensor.

The module is completely assembled with valve terminal and connection block.

Transfer line and workpieces are not included in the scope of delivery.



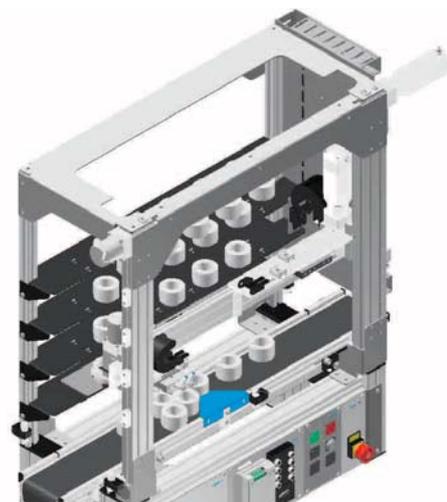
Press-fitting, I/O	C93266
Press-fitting, Profibus-DP	C93268
Press-fitting, Profinet	C93270

### Automatic warehouse module

In the automatic warehouse module, up to 20 stock locations can be filled with workpieces. The handling device is equipped with an angle gripper. The workpieces are detected on the conveyor belt by an optical light barrier, the belt is stopped and the workpiece is brought from there to the appropriate storage location position by the gripper.

The module is completely assembled with valve terminal and connection block.

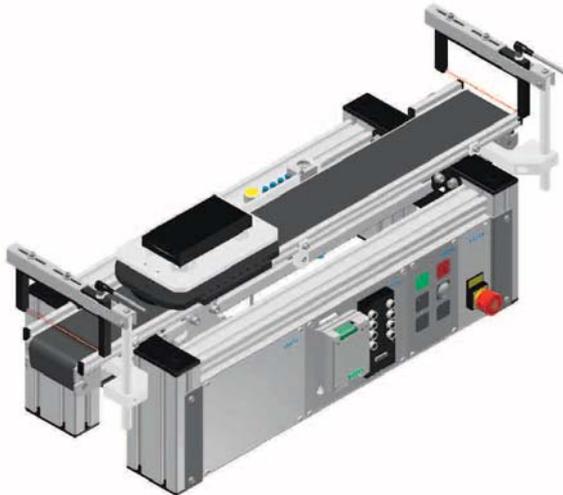
Transfer line and workpieces are not included in the scope of delivery.



Automatic warehouse, I/O	C93256
Automatic warehouse, Profibus-DP	C93258
Automatic warehouse, Profinet	C93285

# MPS® transfer system for workpiece carriers

## Transfer lines and application modules for pallets



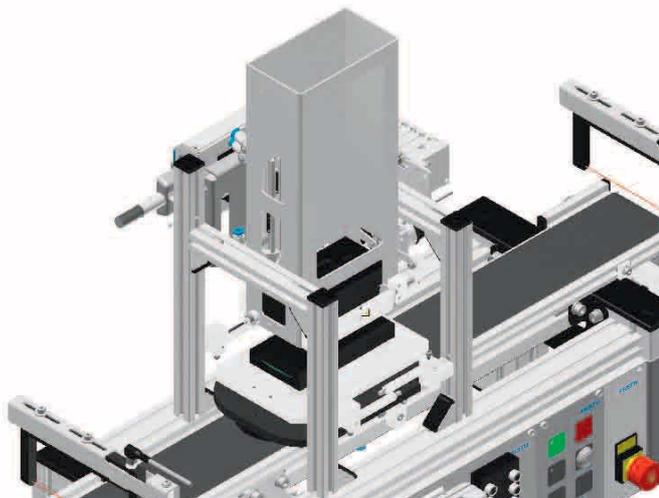
### MPS® pallet transfer line

This MPS® transfer line is the basic component of the MPS® transfer system. It consists of the belt, drive, control elements and stopper unit and comes fully assembled.

In the transfer line MP-EA, the pallets are identified by means of four inductive sensors.

In the transfer line MP-RFID, pallets are additionally identified by means of an RFID write/read system.

MP-EA	C93107
MP-RFID	C93108
Accessories, also order:	
Workpiece carrier MP (1x)	C94430
Workpiece set (5x upper/lower part)	C94429



### Stacking magazine application module

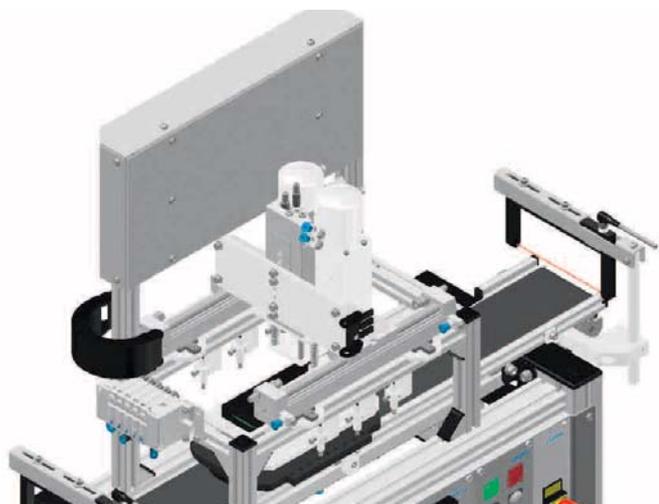
The stacking magazine application module can be attached to a transfer line MP. Housing covers are stored in a magazine shaft. If there is a pallet below the stacking magazine, the lowest housing cover is separated and placed onto the pallet.

### Design

- Module frame made of aluminium profiles
- Stacking magazine
- Valve block
- Sensors
- Signal interface to transfer line

Transfer line, workpieces and workpiece carriers are not included in the scope of delivery.

Stacking magazine	D13007
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### Drilling application module

The drilling application module can be attached to a transfer line MP. Two drilling spindles can be advanced in the Z direction and moved in the X direction. Thus pairs of holes can be introduced into a workpiece.

### Design

- Module frame made of aluminium profiles
- Pneumatic X-axis
- Electromechanical Z-axis
- Two drilling spindles
- Sensors
- Signal interface to transfer module

Transfer line, workpieces and workpiece carriers are not included in the scope of delivery.

Drilling	D13001
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**Tunnel furnace application module**

The tunnel furnace application module can be attached to a transfer line MP. The module is used to control the temperature of workpieces up to a temperature of 90 degrees Celsius.

As a temperature control system, the tunnel furnace exhibits the typical properties of a PTn system with a small delay time.

The application contains components that can similarly also be found in industrial tunnel furnaces

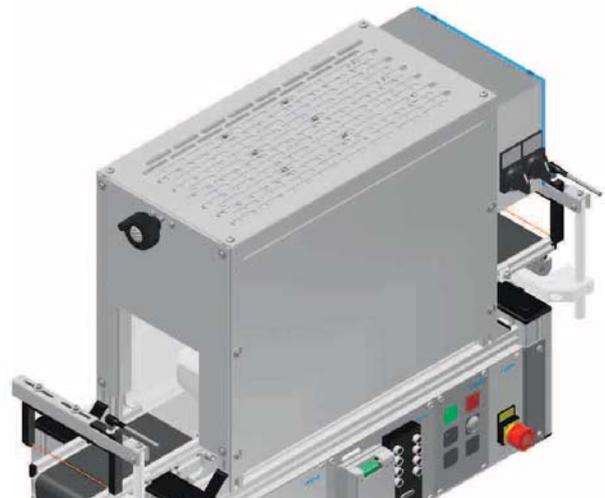
(heating coil, Pt100, electronic load relay).

The properties of a temperature control system and the implementation of quasi-continuous control can be demonstrated with the application.

**Design**

- Stainless steel housing
- Signal interface to transfer line

Transfer line, workpieces and work-piece carriers are not included in the scope of delivery.



Tunnel furnace

D13012

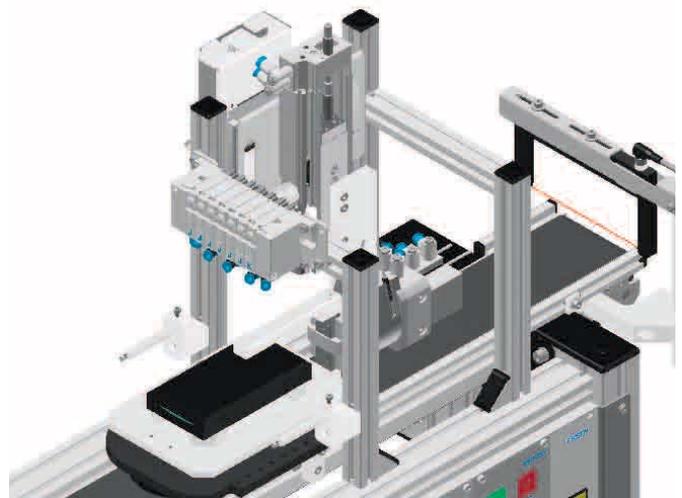
**Turning application module**

The turning application module can be attached to a transfer line MP. Workpieces are turned by means of a pneumatic handling system.

**Design**

- Module frame made of aluminium profiles
- Pneumatic 1-axis handling system with additional rotational drive and gripper
- Valve block
- Sensors
- Signal interface to transfer module

Transfer line, workpieces and work-piece carriers are not included in the scope of delivery.



Turning

D13002

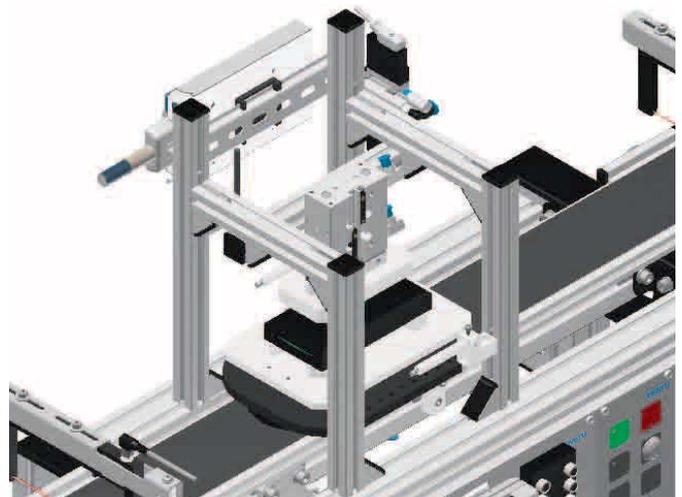
**Joining application module**

The joining application module can be attached to a transfer line MP. Housing upper parts are mounted on the lower part by means of a pneumatic press.

**Design**

- Module frame made of aluminium profiles
- Pneumatic press cylinder
- Valve block
- Sensors
- Signal interface to transfer line

Transfer line, workpieces and work-piece carriers are not included in the scope of delivery.

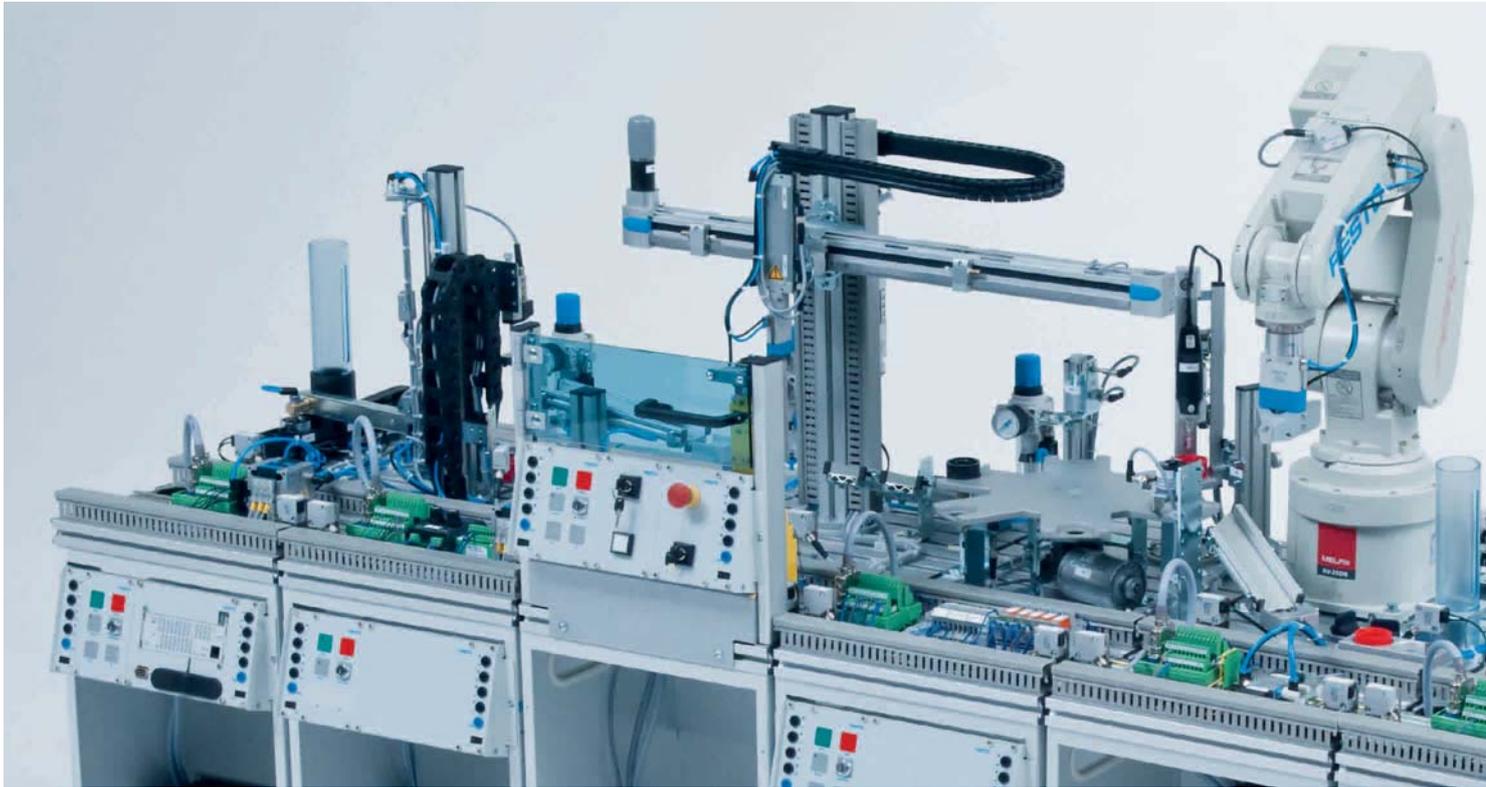


Joining

D13008

# MPS® stations

## Mechatronic systems for world champions

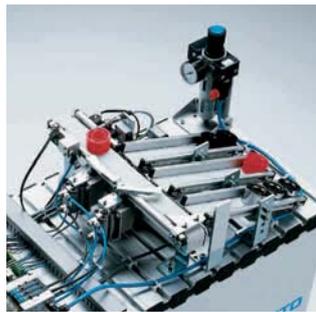


### The MPS® makes history

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 characterise automated production throughout the world: Integration of mechanics, electrical engineering and information technology to create 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 example 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: distribution 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 in whatever way suits you!

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.



### New, state of the art robot

The assembly station with robot has always offered particular added value. It is both a sophisticated mechatronic system in the assembly process as well as a complete learning system for robotics.

The new RV-2SDB represents the continuous development of the MPS®: With 6 axes and a 480° range of motion, it can scratch its own back. With an Ethernet and USB interface, it offers exceptional communication options, while integrated controllers provide scope for additional axes.



### 3D: reflecting reality

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 40 – 45



### Reliable 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 systems are all part of a system made up of MPS® stations.



### Production and assembly

It depends what's important to you: 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.



### Just what you want: choice of PLC

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

As 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 EduTrainer® in the MPS® station is clear: you can remove the controller and use it for other processes or in laboratory furniture.



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

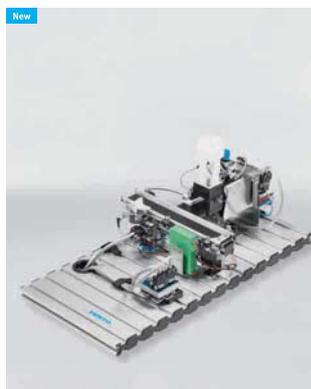
# The stations in the Modular Production System at a glance

New

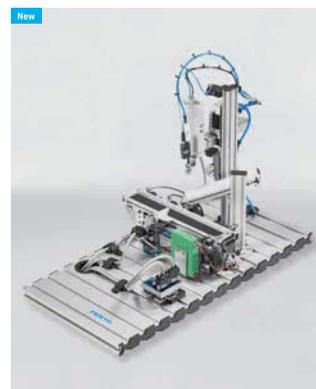
A production line in a factory can be made up of individual production cells. Each cell has a specific function in the process (distribution, testing, processing, handling, assembly, storage). You can select an application or process that meets your requirements from a range of individual stations.

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.



Distributing/Conveyor station



Pick&Place station



Robot station



Robot station with MPS® modules



Distributing station



Testing station



Processing station



Handling station, pneumatic



Handling station, electrical



Fluidic muscle press station



Punching station



Separating station



Storing station

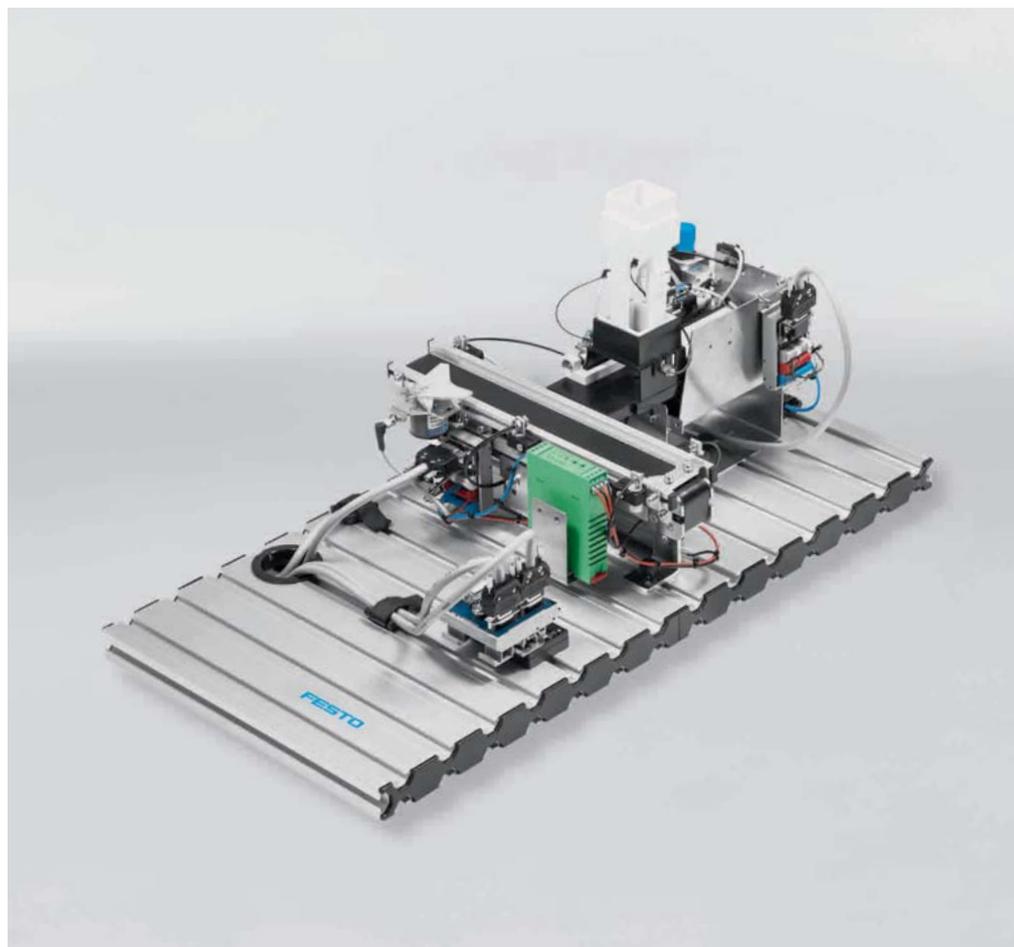


Sorting station

# Distributing/Conveyor station

## Start-up

New



### Function

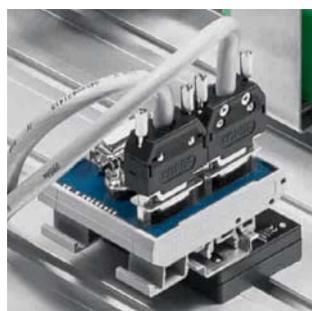
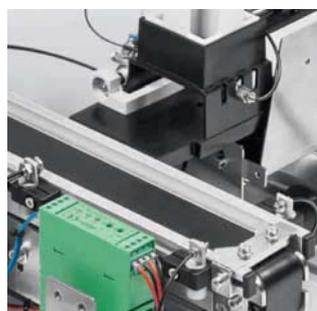
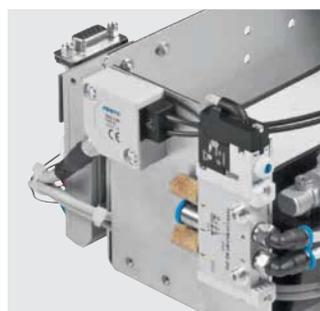
The Distributing/Conveyor station separates workpieces stored in the magazine tube of the stacking magazine. A double-acting cylinder pushes the workpieces out one at a time. The Conveyor module transports the workpiece to the right or left. If required, the workpiece can be stopped and separated on the conveyor.

### Topic: Separating

Both simple and complex programming topics are communicated using the simple magazine structure. Different workpieces can be used in the MPS® Stacking magazine module.

### Topic: Conveying

The MPS® Conveyor module offers a range of training subjects including clockwise/anticlockwise rotation, stopping, separating and opto-electrical sensors.



Distributing/Conveyor station, mounted **8034566**

Additional equipment, also order:

MPS trolley, 700 x 350 → Page 346	
Control console, SysLink	195764
EduTrainer Universal → Page 338 – 341	

Recommended accessories:

Simulation box, digital	170643
PA workpiece set	554301

The most important components at a glance:

1x Aluminium profile plate, 700 x 350 mm, with cable guide	170395
1x Conveyor module, 350 x 40 mm, DC	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

**Training content**

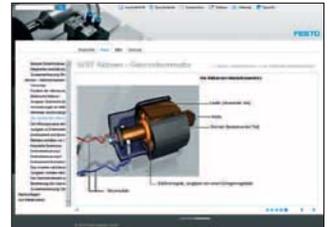
- Belt control
- Reading circuit diagrams
- Buffering and separating
- Basic principles of pneumatics
- Sensor technology: magnetic limit switches, opto-electrical sensors
- Connecting tubing and wiring

**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

**Recommended training media**

- CIROS®
- WBT Actuators – DC motor
- WBT Pneumatics
- WBT Electropneumatics
- WBT GRAFCET
- FluidSIM® Pneumatics design and simulation program
- Textbook Basic principles of pneumatics and electropneumatics



Distributing/Conveyor station with additional equipment



**Light barrier**

The light barrier consists of a sensor with a cable and mounting bracket for a profile or profile plate and a fibre-optic cable. Available in three designs.

1 with holder	196960
without holder	532935
with sleeve	526205



**Valve slice**

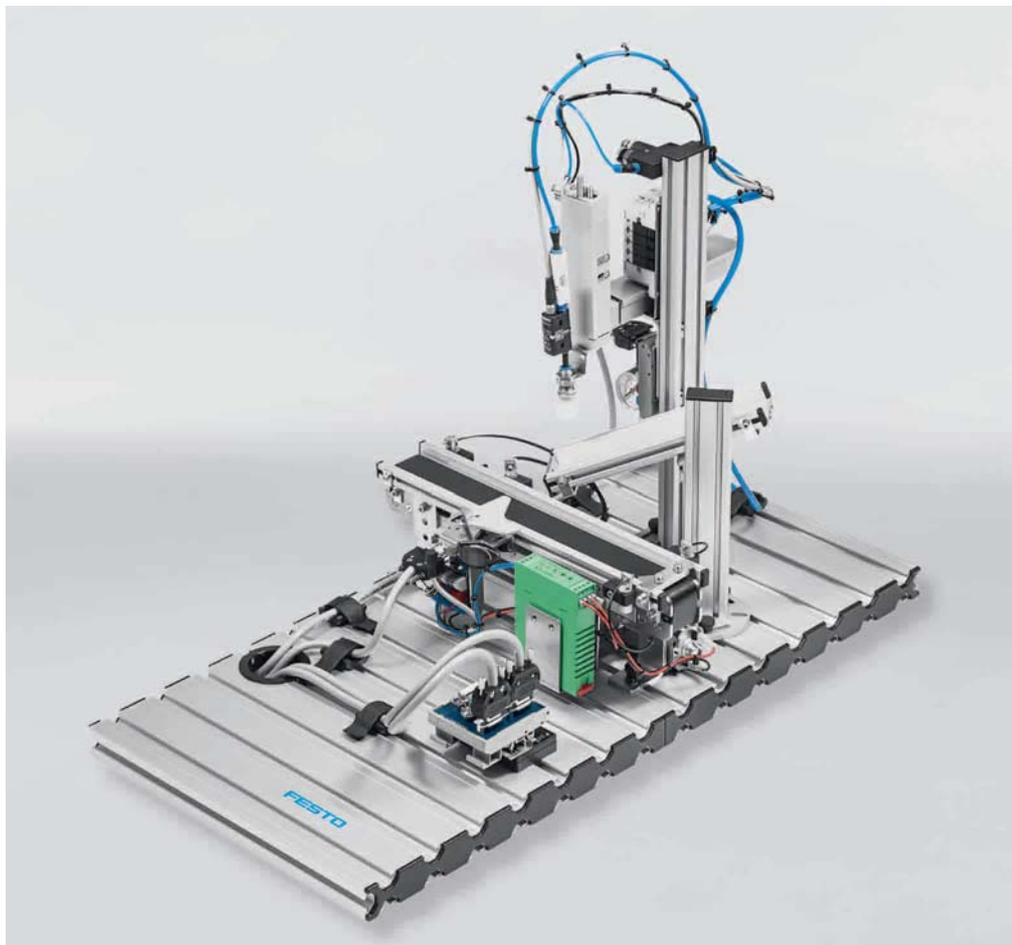
5/2-way single solenoid valve, including 0.5 m valve cable.

Order no. **3035724**

# Pick&Place station

Small is beautiful

New



## Function

The Pick&Place station is equipped with a two-axis Pick&Place module and a Conveyor module. Optical diffuse sensors or through-beam sensors detect the workpiece housing placed on 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 separator and transported to the end of the conveyor.

Additional functions can be produced using the Pick&Place station.

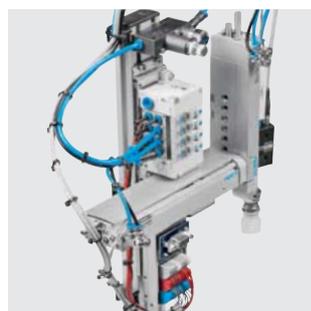
- Rejection of workpieces (housing or cylinder bodies) on the slide
- Alternative feeding of workpieces (housing or cylinder bodies) from the slide

## Topic: Linear slide units

Slide units from Festo can be used to further extend the versatility of the Pick&Place module. Variable stops, silencers and an attachment that can be adjusted in all directions provide the ideal solution for every Pick&Place task. This permits a wide range of projects to be implemented.

## Topic: Vacuum technology

The vacuum components vacuum generators, pressure switches, vacuum filters and suction cups are harmonised for optimum performance. They clearly demonstrate the principle behind vacuum applications: vacuum generation using a generator, the correct suction cup with matching filter and the teach-in electronic pressure switch with freely programmable switching points for pressure sensing.



Pick&Place station, mounted **8034567**

Additional equipment, also order:

MPS trolley, 700 x 350 → Page 346	
Control console, SysLink	195764
EduTrainer Universal → Pages 338 – 341	

Recommended accessories:

Simulation box, digital	170643
PA workpiece set	554301

The most important components at a glance:

1x Aluminium profile plate, 700 x 350 mm, with cable guide	170395
1x Conveyor module, 350 x 40 mm, DC	8032692
1x Pick&Place module, With vacuum technology	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

#### Training content

- Basic principles of pneumatics
- Sensor technology: magnetic limit switches, opto-electrical sensors
- Connecting tubing and wiring
- Reading circuit diagrams
- Getting to know handling systems
- Vacuum technology/gripper technology
- Belt control
- Buffering and separating

#### 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

#### Recommended training media

- CIROS®
- WBT PLC programming in accordance with IEC 61131
- WBT Pneumatics
- WBT Electropneumatics
- WBT Sensor technology 1 and 2
- FluidSIM® Pneumatics design and simulation program
- Textbook Basic principles of pneumatics and electropneumatics
- Equipment set TP 230 – Vacuum technology, Advanced Level
- Workbook Basic principles of vacuum technology, TP 230



Pick&Place station with additional equipment



#### Diffuse sensor

The diffuse sensor consists of a sensor with a cable and mounting bracket for a profile/profile plate and a fibre-optic cable. Available in two designs.

1 with holder	196959
without holder	526212



#### DC motor controller for clockwise/anti-clockwise rotation

Motor control for 24 V DC brushed DC motors. Control voltage 24 V DC, galvanic isolation between input and output circuits, reverse polarity protection on input side, can be clicked onto the DIN bus bars EN 50022 and EN 50035.

Order no.	567245
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## Robot station

### The base for your robot applications

New



#### 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	8039312
Additional equipment, also order:	
MPS trolley, 700 x 350 → Page 346	
Control console, SysLink, 700 mm	8039325
Tabletop power supply unit → Page 239	
Robot handling module	8038620
Robot assembly module	8038740
Robot interface box	534364
Graphical operator terminal	8039317

Battery set for robot RV-2FB	572162
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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, de/en	8039315
Technical manual for Mitsubishi robot RV-2FB, de/en	8039316

The most important components at a glance:	
1x Aluminium profile plate 700 x 700	159410
1x Robot RV-2FB with Teachbox R32TB	3396765
1x Gripper, pneumatic	573859
1x Safety housing	8039314
1x Start-up valve with filter control valve	540691

**CIROS® programming and simulation software**

CIROS® is a professional basic and further training tool that makes programming and simulation of a precision robot extremely easy and safe.  
→ Pages 40 – 45



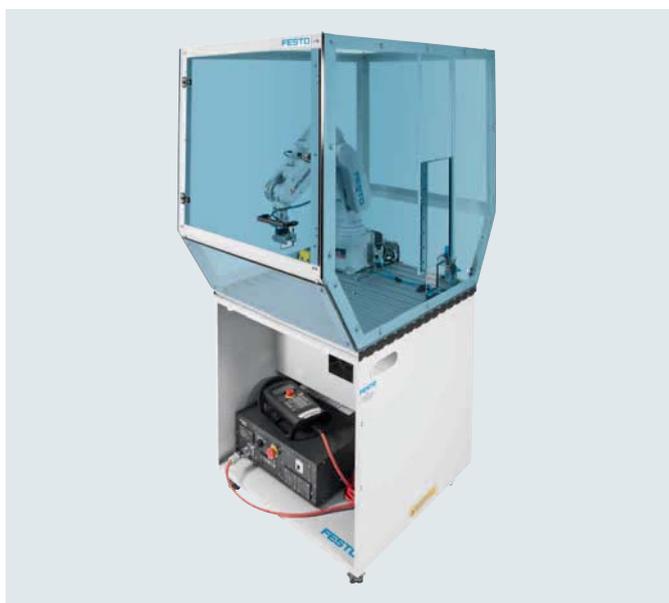
**Training content**

- 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

More learning and research systems for robot technology:  
– Robot Vision Cell  
→ Pages 358 – 361  
– Robotino®  
→ Pages 258 – 269



Robot station with additional equipment



**Robot RV-2FB with Teachbox R32TB**  
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 a standard handheld terminal R32TB.  
Order no. 3396765

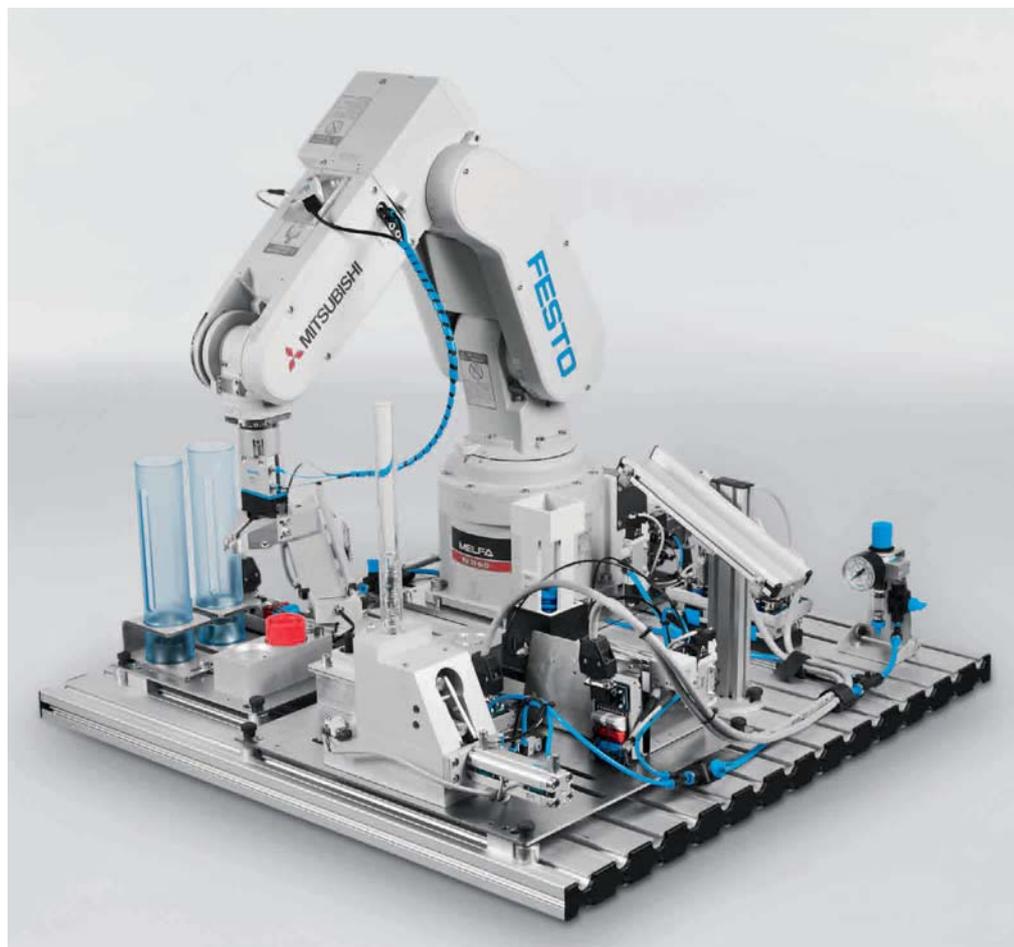


**Robot RV-2FB with R56TB touch panel**  
High-precision 6-axis articulated arm robot with gear units by Harmonic Drive AG and brakes on all axes. Complete with control unit, programming cable, battery set and handheld terminal R56TB, which conveniently provides all programming functions via a 6.5" graphical touchscreen.  
Order no. 3481428

## Robot station with MPS® modules

The equipment level as an introduction to industrial robotics

New



### 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.

### 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

### Technical data

- Power supply: 230 V AC
- Operating pressure: 600 kPa (6 bar)
- Maximum workpiece width: 40 mm
- 12 digital inputs
- 5 digital outputs



Order no.

8039313

## Robot handling module

New



The robot handling module extends the MPS® 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 colour (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

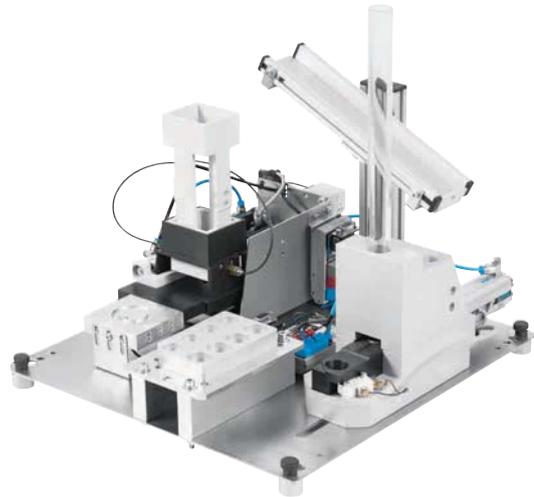
Order no. **8038620**

#### 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

New



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

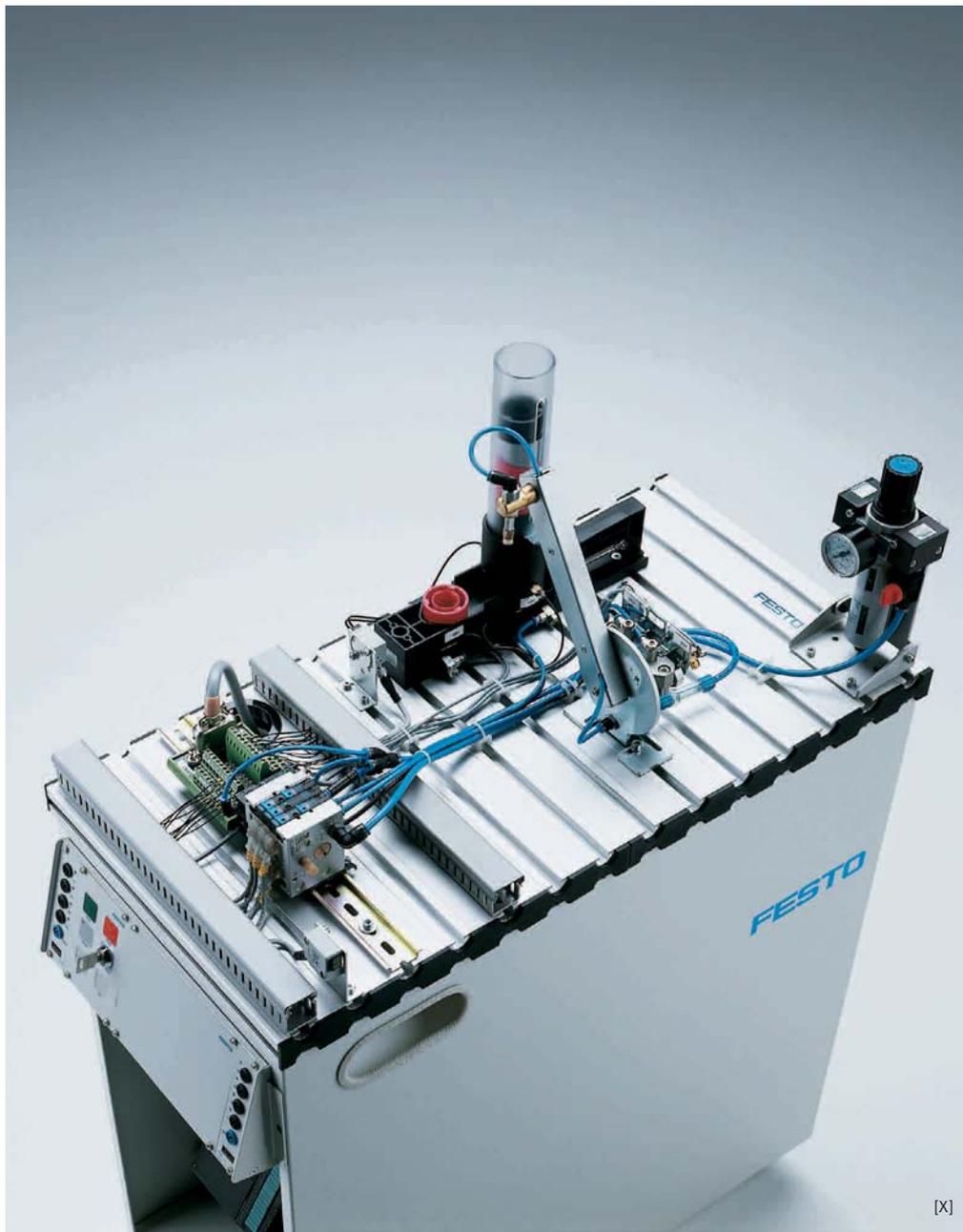
Order no. **8038740**

#### 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

# Distributing station

## Getting started with MPS®



### Function

The Distributing station separates workpieces. Up to eight workpieces are stored in the magazine tube of the stacking magazine. A double-acting cylinder pushes the workpieces out one at a time. The Changer module grips the separated workpiece via a suction gripper. The swivel arm of the changer, which is driven by a rotary actuator, moves the workpiece to the transfer point of the downstream station.

### Special technology:

#### Semi-rotary actuator

The Distributing station utilises various actuators, all of which are industrial components. The rotary actuator of the swivel arm can be set to various angles between 90° and 270°. The end positions are sensed by means of micro switches. A double-acting linear cylinder pushes workpieces out of the stacking magazine. The end positions are sensed using proximity sensors.

### Special grippers:

#### Suction gripper

The suction gripper of the Changer module grips the workpiece. The vacuum is generated in the vacuum slice of the CP valve terminal by means of the venturi principle and is monitored by a pressure switch. The switching point of the pressure switch is adjustable.



Distributing station, mounted	195780
Kit Distributing station	526880

Additional equipment, also order:

MPS trolley, 700 x 350 → Page 346	
Control console, SysLink	195764
EduTrainer Universal → Pages 338 – 341	

Recommended accessories:

Simulation box, digital	170643
Workpiece set "Cylinder bodies"	167021

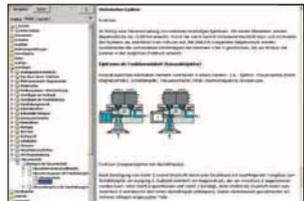
**Technical data**

- Operating pressure 600 kPa (6 bar)
- Power supply 24 V DC
- 7 digital inputs
- 5 digital outputs

**Training aims for project work**

- Mechanical:
- Mechanical set-up of a station
- Pneumatics:
- Installation of tubing for pneumatic components
  - Vacuum technology
  - Pneumatic linear and rotary drives
- Electrical:
- Correct wiring of electrical components
- Sensors:
- Correct application of limit switches
- PLC:
- Programming and application of a PLC
  - Structure of a PLC program
  - Programming an operating mode section
  - Orderly RESET sequence
  - Programming an EMERGENCY STOP

**Recommended training media**

- WBT Discover MPS® 200
- 
- WBT PLC programming in accordance with IEC 61131
  - WBT GRAFCET
  - WBT Pneumatics
  - Mechatronics Assistant
- 
- Training document Distributing station
  - Design and simulation program FluidSIM® Pneumatics
  - Virtual process environment CIROS®
  - Textbook Pneumatics, Basic level
  - Textbook Programmable logic controllers, Basic level



**Start-up valve with filter control valve**

Filter control valve with Pressure gauge and Start-up valve mounted on adapter with adjustable angle. The Start-up valve pressures/exhausts the connected pressure zone.

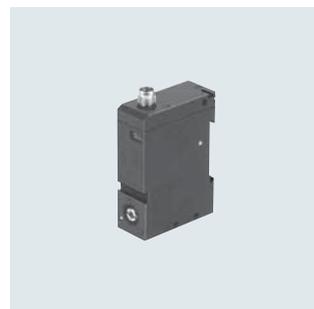
Order no. **540691**



**Changer module**

The Changer module is a pneumatic handling device. A suction cup is used to pick up workpieces and relocate them to positions from 0° to 180° using a semi-rotary drive. Sensors assume end-position detection.

Order no. **162387**



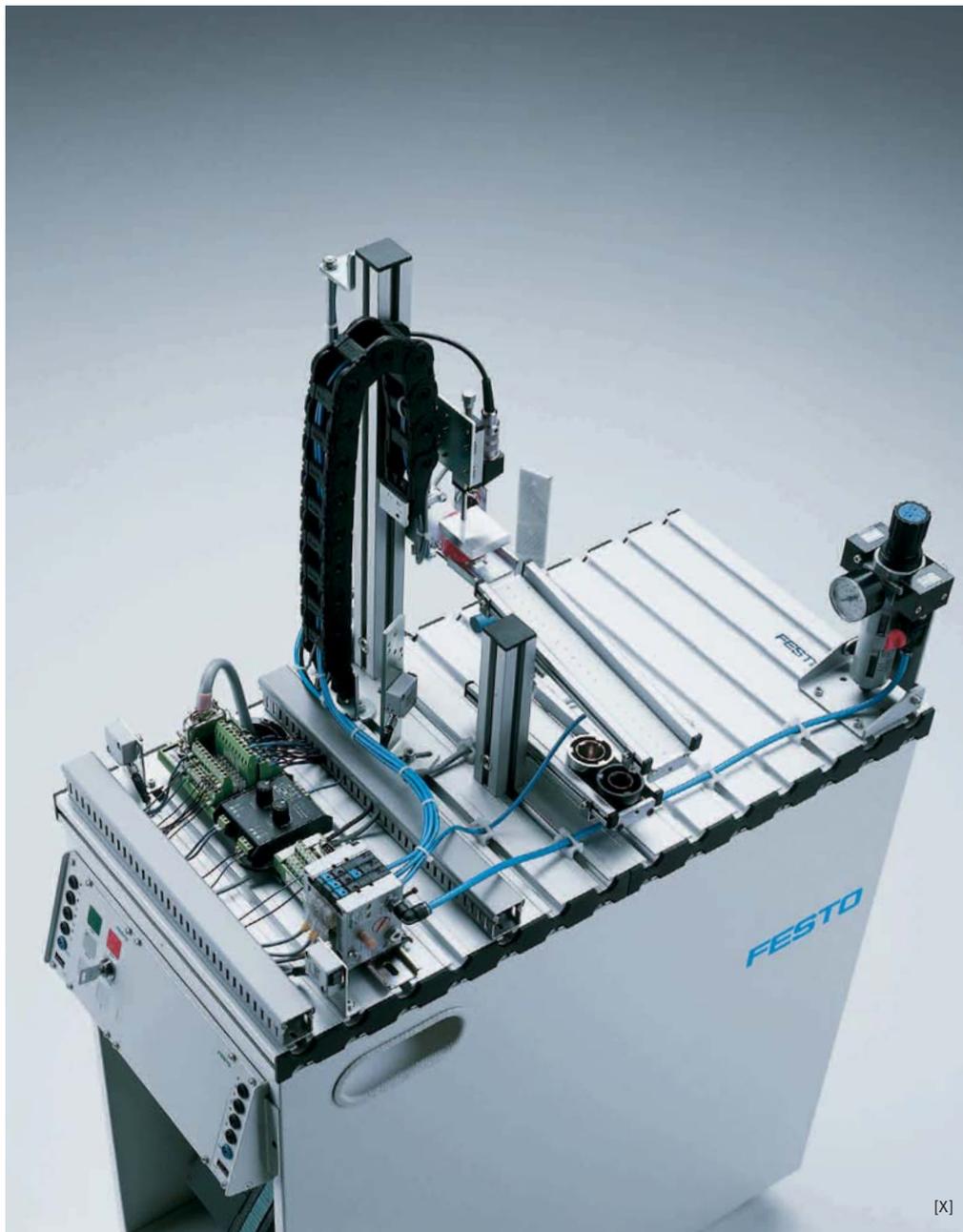
**Vacuum switch**

Mechanical vacuum switch with adjustable switching point and switching status display (LED).

Order no. **196973**

# Testing station

## Focus on sensors



### Function

The Testing station detects the various properties of the workpieces inserted into it. It differentiates workpieces with the aid of an optical and a capacitive sensor. A retro-reflective sensor monitors whether the operating space is free before the workpiece is raised via a linear cylinder. An analogue sensor measures the height of the workpiece. A linear cylinder guides correct workpieces via the upper air slide to the neighbouring station. Faulty workpieces are rejected via the lower air slide.

### Top topic:

#### Sensors

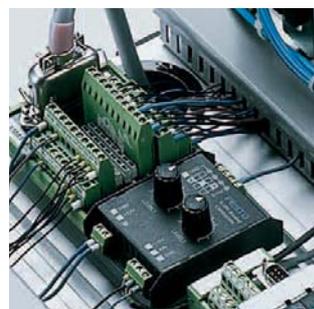
The Testing station employs all basic types of industrial sensors in typical applications: optical and capacitive proximity sensors and optical retro-reflective sensors. These are supplemented by various cylinder limit switches (inductive, magnetic).

### Option:

#### Analogue value processing

An analogue sensor detects the height of the workpiece, which is raised from below by a linear cylinder and pressed against the measuring device. A comparator evaluates the sensor signal and passes this on as a digital signal. The analogue signal is also available at a separate terminal – allowing connection to the simulation box or a PLC with an analogue module.

[X]



Testing station, mounted	195781
Kit Testing station	526881

Additional equipment, also order:

MPS trolley, 700 x 350 → Page 346	
Control console, SysLink	195764
EduTrainer Universal → Pages 338 – 341	

Recommended accessories:

Simulation box, digital/analogue	526863
Workpiece set "Cylinder bodies"	167021

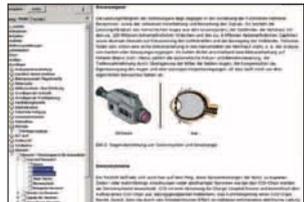
**Technical data**

- Operating pressure 600 kPa (6 bar)
- Power supply 24 V DC
- 8 digital inputs
- 5 digital outputs

**Training aims for project work**

- Mechanical:
- Mechanical set-up of a station
- Pneumatics:
- Application of rodless cylinders
- Electrical:
- Correct wiring of electrical components
- Sensors:
- Mode of operation and applications of optical and capacitive sensors with digital switching behaviour
  - Mode of operation and applications of analogue sensors using the example of an analogue displacement encoder
- PLC:
- Programming and application of a PLC
  - Analogue signal processing
- Commissioning:
- Commissioning of the entire sequence
- Troubleshooting:
- Systematic troubleshooting in a production system

**Recommended training media**

- WBT Sensor technology 2
- 
- Mechatronics Assistant
- 
- Design and simulation program FluidSIM® Pneumatics
  - Textbook Programmable logic controllers, Basic level
  - Textbook Proximity sensors
  - Virtual process environment CIROS®



**Recognition module**

The Recognition module comprises two different sensors and a mounting bracket.

Order no. **526850**



**Lifting module**

Lifting of a workpiece by means of a rodless cylinder. In this position the workpiece can be checked by the Measuring module. The workpiece is ejected by a second cylinder.

Order no. **532954**



**Measuring module**

The Measuring module enables the height of a workpiece to be measured by a linear displacement sensor. It can be attached directly to the Lifting module. The linear displacement sensor is connected to a comparator, allowing simple evaluation of the result of the measurement.

Order no. **195779**



**Pneumatic slide module**

The slide is universally mounted on a profile. The slide characteristics can be adjusted by means of the flow control valve on the underside of the slide.

Order no. **526217**

# Processing station

## Purely electrical



### Function

In the Processing station, workpieces are tested and processed on a rotary indexing table. This station only uses electrical drives. The rotary indexing table is driven by a DC motor. The table is positioned by a relay circuit, with the position of the table being detected by an inductive sensor. On the rotary indexing table, the workpieces are tested and drilled in two parallel processes. A solenoid probe with an inductive sensor checks that the workpieces are inserted in the correct position. During drilling, the workpiece is clamped by a solenoid actuator. Finished workpieces are passed on via the electrical sorting gate.

### Attention!

#### Drilling operation

Drill feed is undertaken by an electrical linear axis with a DC motor, which is controlled via a reversing starter. The end positions are sensed by means of micro switches. The drill is fully functional, but for safety reasons the drilling processes are only simulated.

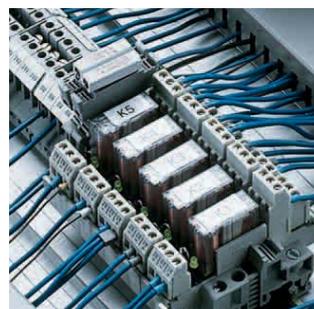
### Electrical only:

#### Many different drives

The station requires the programming of two processes executed in parallel: drilling and drill-hole testing. This station also offers a range of different drives:

- DC drill
- DC motor on rotary indexing table
- Electrical linear drive for drill feed
- Electrical sorting gate
- Solenoid actuator in the clamping module and the Testing module

[X]



Processing station, mounted	195782
Kit Processing station	526882

Additional equipment, also order:

MPS trolley, 700 x 350 → Page 346	
Control console, SysLink	195764
EduTrainer Universal → Pages 338 – 341	

Recommended accessories:

Simulation box, digital	170643
Workpiece set "Cylinder bodies"	167021

**Technical data**

- Power supply 24 V DC
- 8 digital inputs
- 8 digital outputs

**Training aims for project work**

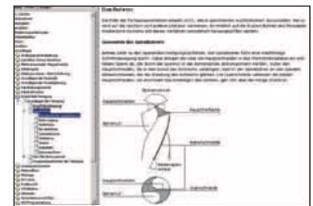
- Mechanical:
- Mechanical set-up of a station
  - Selection of linear drives
- Electrical:
- Correct wiring of electrical components
- Sensors:
- Correct application of limit switches
- PLC:
- Programming of logic controllers and parallel step sequences
- Troubleshooting:
- Systematic troubleshooting in a production system
- Handling technology:
- Checking incoming workpieces

**Recommended training media**

- WBT Actuators – DC motor



- Mechatronics Assistant



- Textbook Programmable logic controllers, Basic level
- Virtual process environment CIROS®



**Testing module**

The Testing module consists of a solenoid probe with an inductive sensor for sensing. The module can be used for the testing of workpieces: simple drill-hole checking, simple height checking, workpiece position checking.

Order no.	195773
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**Drilling module**

The Drilling module comprises a drilling machine attached to a linear axis driven by a DC motor. The end positions are sensed by means of micro switches.

Order no.	196974
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**Rotary indexing table module**

Rotary indexing table with 6 workpiece positions. The table is driven by a DC geared motor with a series resistor.

Order no.	654972
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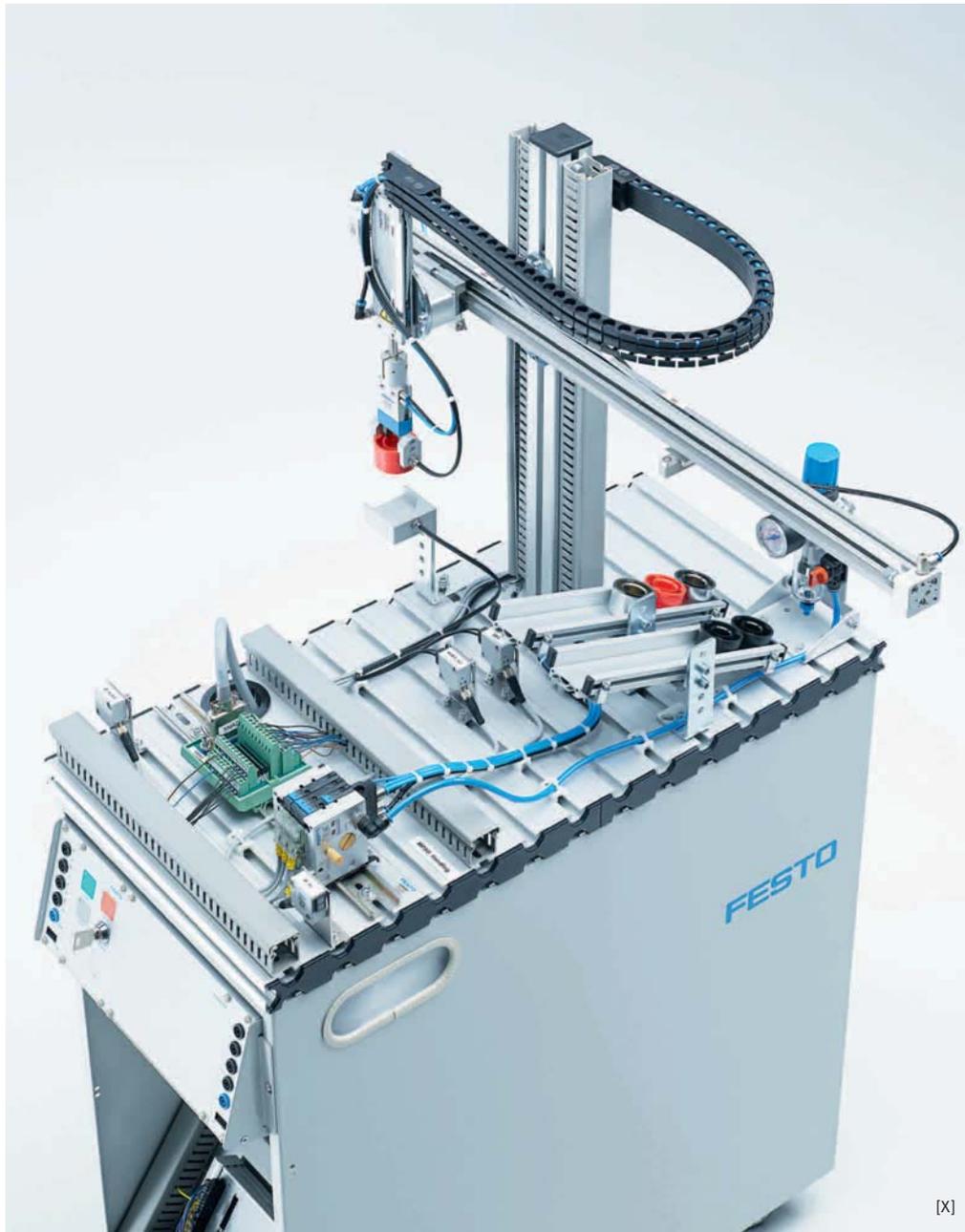
**Clamping/ejecting module**

For mounting on a profile plate. An electrical solenoid is used for the drive (Working stroke = 9 mm).

Order no.	526218
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# Handling station, pneumatic

## All-rounder with pneumatic linear drive



### Function

The Handling station, pneumatic, is equipped with a flexible two-axis handling device. Workpieces inserted into the holder are detected by an optical diffuse sensor. The handling device picks up the workpieces from there with the aid of a pneumatic gripper. The gripper is equipped with an optical sensor which differentiates between “black” and “non-black” workpieces. The workpieces can be placed on different slides according to this criterion. Other sorting criteria can be defined if the station is combined with other stations. Workpieces can also be transferred to a downstream station.

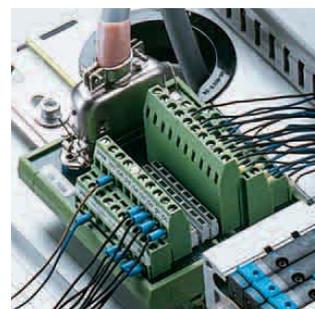
### Good example: Modular handling system from Festo

The Handling station, pneumatic, utilises industrial handling components. A pneumatic linear axis with flexible end-position adjustment and cushioning allows fast positioning, including to intermediate positions. A flat linear cylinder with end-position detection serves as the lifting cylinder for the Z axis. A modern pneumatic linear gripper is mounted on the lifting cylinder. The optical sensor integrated into the jaw of the gripper recognises the workpieces.

### Project exercise: New requirements – different grippers

The PicAlfa module, pneumatic, is highly flexible: stroke length, inclination of the axes, arrangement of the end-position sensors and the installation position can all be adjusted. This enables the station to be adapted for a broad range of handling tasks without the use of additional elements – an ideal project for advanced trainees.

[X]



Handling station pneumatic, mounted	195783
Kit Handling station, pneumatic	526883

Additional equipment, also order:

MPS trolley, 700 x 350 → Page 346	
Control console, SysLink	195764
EduTrainer Universal → Pages 338 – 341	

Recommended accessories:

Simulation box, digital	170643
Workpiece set “Cylinder bodies”	167021
Workpiece set “For cylinder assembly”	162239

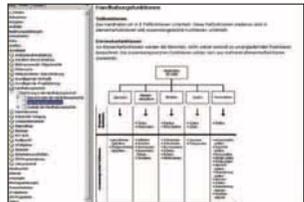
**Technical data**

- Operating pressure 400 kPa (4 bar)
- Power supply 24 V DC
- 8 digital inputs
- 5 digital outputs

**Training aims for project work**

- Mechanical:
- Mechanical set-up of a station
- Pneumatics:
- Installation of tubing for pneumatic components
  - Pneumatic grippers
  - Pneumatic linear drives
- Electrical:
- Correct wiring of electrical components
- Sensors:
- Correct application of limit switches
- PLC:
- Programming and application of a PLC
  - Control of a handling device
- Commissioning:
- Commissioning of the entire sequence
  - Optimisation of cycle time
  - Safety in the event of loss of pneumatic or electrical power

**Recommended training media**

- WBT Electropneumatics
- 
- Mechatronics Assistant
- 
- Design and simulation program FluidSIM® Pneumatics
  - Textbook Programmable logic controllers, Basic level



**PicAlfa module, pneumatic**  
 Universal 2-axis handling device for “Pick & Place” tasks. Stroke length, inclination of the axes and arrangement of the end-position sensors and mounting position can be adjusted.  
 Order no. **526215**



**Holder module**  
 The Holder module comes complete with a holder for mounting on a profile plate.  
 Order no. **195777**



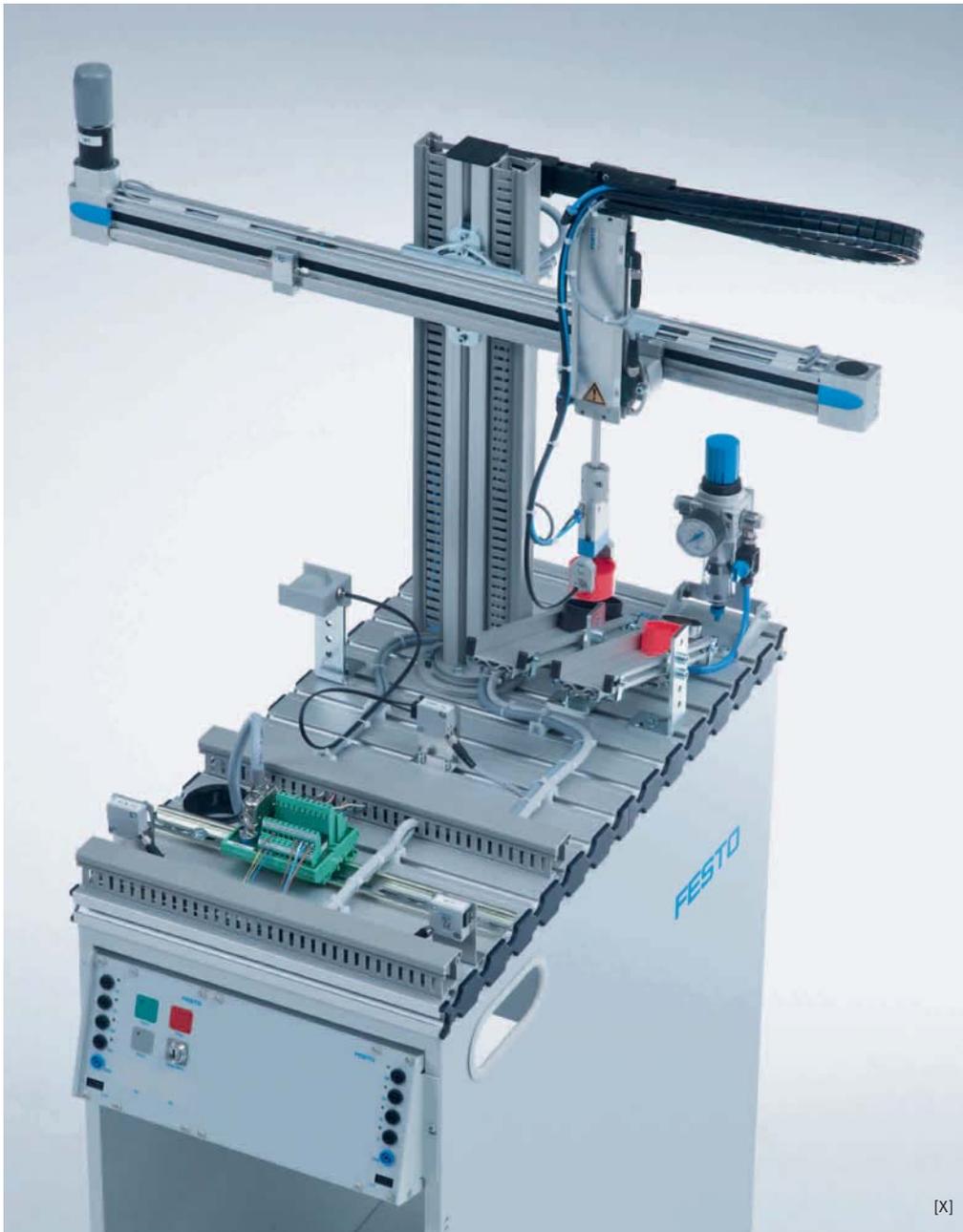
**Diffuse sensor**  
 The fibre optic diffuse sensor can be mounted directly in the pickup module, at the end of a slide or on a gripper.  
 Order no. **526212**



**Slide module**  
 The slide comes complete with a retainer for mounting on a profile plate.  
 Order no. **653393**

# Handling station, electrical

## Up-to-date with electric drives



### Function

The Handling station, electrical, is equipped with a flexible two-axis handling device. Workpieces inserted into the holder are detected by an optical diffuse sensor. The handling device picks up the workpieces from there with the aid of a pneumatic gripper. The gripper is equipped with an optical sensor which differentiates between “black” and “non-black” workpieces. The workpieces can be placed on different slides according to this criterion. Other sorting criteria can be defined if the station is combined with other stations. Workpieces can also be transferred to a downstream station.

### Good example: Modular handling system from Festo

The Handling station, electrical, utilises industrial handling components. An electrical linear axis with DC motor allows fast positioning, including to intermediate positions. A flat linear cylinder with end-position detection serves as the lifting cylinder for the Z axis. A modern pneumatic linear gripper is mounted on the lifting cylinder. The optical sensor integrated into the jaw of the gripper recognises the workpieces.

### Project exercise: New requirements – different grippers

The PicAlfa module, electrical, is highly flexible: stroke length, inclination of the axes, arrangement of the end-position sensors and the installation position can all be adjusted. This enables the station to be adapted for a broad range of handling tasks without the use of additional elements – an ideal project for advanced trainees.

The valve terminal in the electric PicAlfa module is equipped with two individual single-solenoid valves. This makes it possible to carry out simple extensions, such as adding a stacking machine.



Handling station electrical, mounted	567203
Kit Handling station electric	567256

Additional equipment, also order:

MPS trolley, 700 x 350 → Page 346	
Control console, SysLink	195764
EduTrainer Universal → Pages 338 – 341	

Recommended accessories:

Simulation box, digital	170643
Workpiece set “Cylinder bodies”	167021
Workpiece set “For cylinder assembly”	162239

**Technical data**

- Operating pressure 400 kPa (4 bar)
- Power supply 24 V DC
- 8 digital inputs
- 7 digital outputs

**Training aims for project work**

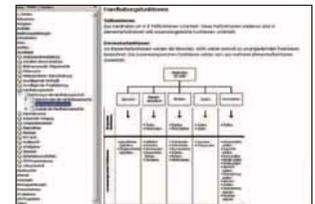
- Mechanical:**
  - Mechanical set-up of a station
- Pneumatics:**
  - Installation of tubing for pneumatic components
  - Pneumatic grippers
  - Pneumatic linear drives
- Electrical:**
  - Correct wiring of electrical components
- Sensors:**
  - Correct application of limit switches
- PLC:**
  - Programming and application of a PLC
  - Control of a handling device
- Drive technology:**
  - I/O actuation of drive controllers
- Commissioning:**
  - Commissioning of electrical axes
  - Commissioning of the entire sequence
  - Optimisation of cycle time
  - Safety in the event of loss of pneumatic or electrical power

**Recommended training media**

- WBT Actuators – DC motor



- WBT Safety engineering
- WBT Electropneumatics
- Mechatronics Assistant



- Design and simulation program FluidSIM® Pneumatics
- Textbook Programmable logic controllers, Basic level



**PicAlfa module, electrical**

Universal 2-axis handling device for “pick & place” tasks. Stroke length, inclination of the axes and arrangement of the limit switches and mounting position can be adjusted. All components for activating the module are on the support profile.

Order no. **567255**



**Valve terminal – Smart Cubic**

The miniaturised valve terminal for almost any application. The Smart Cubic has a highly compact design with sufficient volumes for miniaturised drives in the electronics industry, and is optimised for Festo miniature drives.

- Multi-pin cable D-Sub, 15-pin
- Valve positions: 2 x 5/2-way monostable, 1 x 5/2-way bistable

Order no. **572782**



**Multi-pin plug distributor**

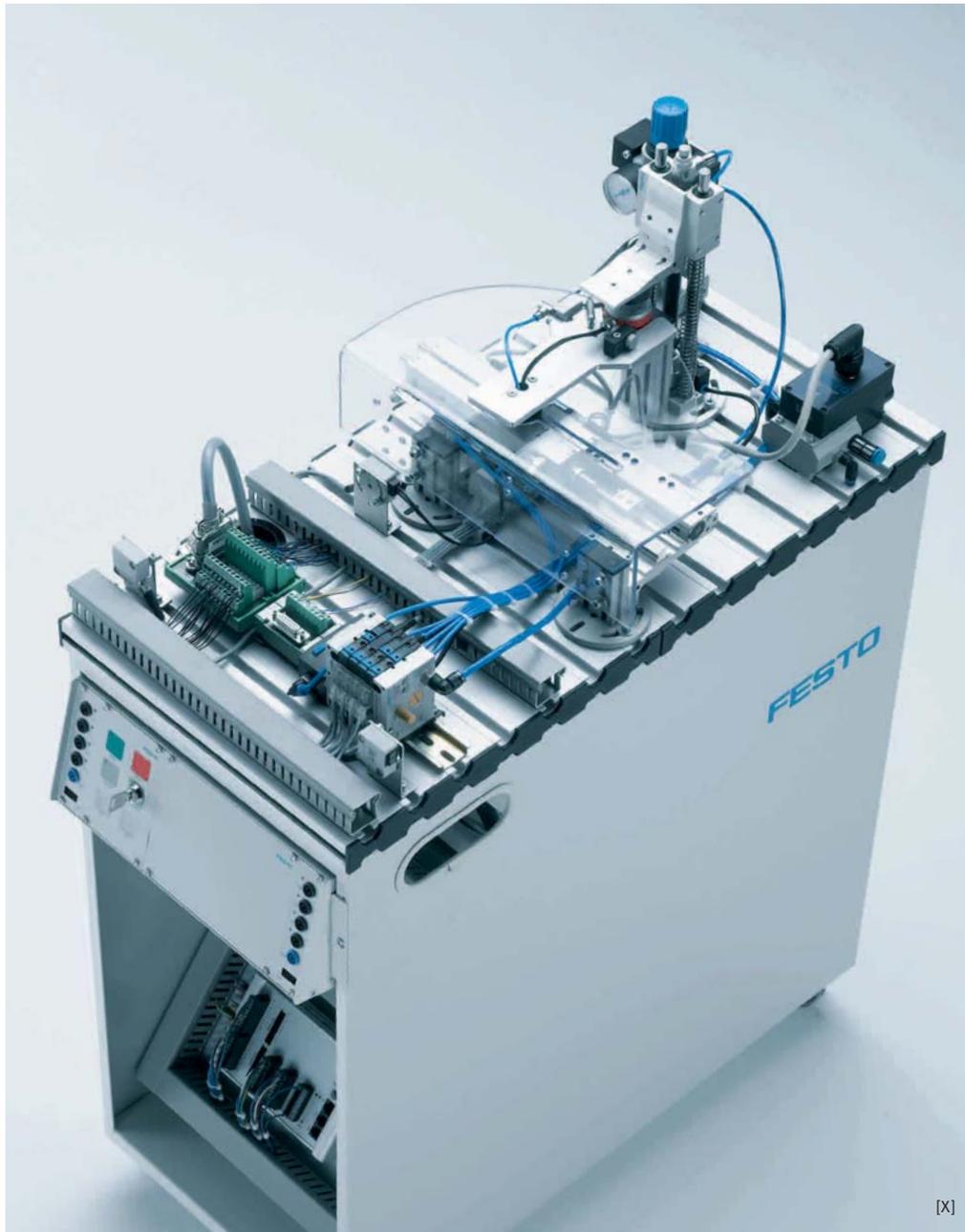
For connecting up to 8 sensors with a 3-pin Connector M8.

- Operating voltage range: 10 – 30 V DC
- Acceptable current load per slot: 1 A
- Total acceptable current load: 4 A
- Including multi-pin cable D-Sub, 15-pin

Order no. **572783**

# Fluidic Muscle Press station

## Powerful



### Function

The Fluidic Muscle Press station presses workpiece inserts into the housings. The rotary/linear actuator (transfer device) moves the housing with the insert placed on it under the press. The pneumatic muscle performs the pressing operation. The finished workpiece is then transported to the transfer position using the rotary/linear actuator. An optical diffuse sensor is attached to the arm of the actuator for sensing the workpiece. The pressing pressure is monitored and displayed using the analogue pressure sensor. The press-in speed and depth can be varied both manually – via throttle and pressure regulator – and electronically – via the proportional pressure regulator.

### State of the art

The latest components such as the pneumatic muscle, the linear drive SLG or the semi-rotary actuator DRQD with adjustable mid-position enable your students to experience the industrial automation technology of tomorrow today.

### Option:

#### Analogue value processing

The analogue pressure sensor provides an analogue signal and also a binary signal with the help of the programmable switching points. The analogue signals are available at a separate terminal – allowing connection to the simulation box or a PLC with an analogue module. This enables you to use the station with a controller with or without analogue processing. Both variants are supported for actuation of the pneumatic muscle: Analogue via the proportional pressure regulator or binary via a directional control valve.

[X]



Fluidic muscle press station, mounted	535248
Kit Fluidic muscle press station	538707

Additional equipment, also order:

MPS trolley, 700 x 350 → Page 346	
Control console, SysLink	195764
EduTrainer Universal → Pages 338 – 341	

Recommended accessories:

Simulation box, digital/analogue	526863
Workpiece set "Housings"	534619
Workpiece insert "Clock"	534621
Workpiece insert "Thermometer"	534622
Workpiece insert "Hygrometer"	534623

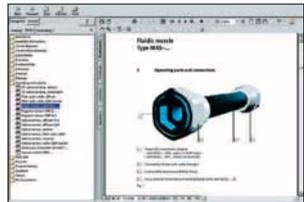
**Technical data**

- Operating pressure 600 kPa (6 bar)
- Power supply 24 V DC
- 8 digital inputs  
(1 analogue input can additionally be used)
- 7 digital outputs  
(1 analogue output can additionally be used)

**Training aims for project work**

- Mechanical:
- Mechanical set-up of a station
- Pneumatics:
- Application of linear slide units
  - Application of semi-rotary drives
  - Application of pressure regulators
  - Application of pneumatic muscle
- Electrical:
- Correct wiring of electrical components
- Sensors:
- Application of end-position sensors and optical diffuse sensors
  - Mode of operation and applications of analogue sensors using the example of an analogue pressure sensor
- PLC:
- Programming and application of a PLC
  - Analogue signal processing

**Recommended training media**

- WBT Sensor technology 1
- 
- Mechatronics Assistant
- 
- Design and simulation program FluidSIM® Pneumatics
  - Textbook Programmable logic controllers, Basic level
  - Textbook Proximity sensors
  - Virtual process environment CIROS®



**Rotary/linear transfer module**

The module contains a precision SLG linear slide unit with adjustable end stops. The rotary movement is realised using a DRQD semi-rotary drive. This permits rotation of 90° and 180°. All end positions are sensed by means of sensors.

Order no. **535249**



**Fluidic Muscle Press module**

The module is used to press workpiece inserts into the housing. The press is actuated using a pneumatic muscle. The module contains a manually adjustable pressure regulator that can be used to adjust the press-in depth. The press-in speed is adjusted via supply air flow control.

Order no. **535251**



**Pressure sensor**

Pressure sensor with LCD display, measuring range 0 – 10 bar with analogue output 0 – 10 V and PNP switch output, selectable via teach-In. Supplied complete with connection cable.

Order no. **679598**



**Analogue terminal**

Analogue signals are passed to a special analogue terminal with a 15-pin Sub-D socket. To wire up and connect analogue signals.

Order no. **526213**

# Punching station

## Hydraulics power



### Function

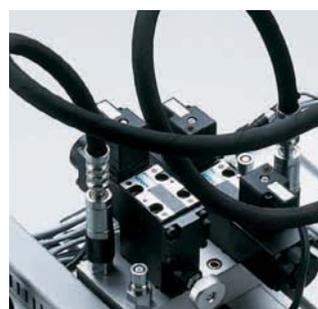
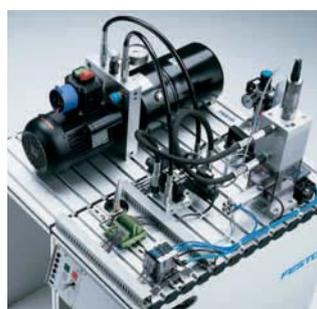
The plastic cylinder end caps for the cylinder bodies are supplied without a hole for the piston rod. This station has the task of punching the hole. A double-acting cylinder ejects the semifinished cap from the stacking magazine. A second cylinder brings the cap into the punch. After punching, this second cylinder ejects the finished cap.

### Topic:

#### Pressure and force

Hydraulics plays a key role in mechatronic systems when great forces are required. It is an essential part of drive and control technology for mechatronics training.

The pressure for the punching process is supplied by the hydraulic power unit. A pressure switch on the punch itself ensures the correct pressure for the punching process.



Punching station, mounted	195787
Kit Punching station	526887

Additional equipment, also order:

2x MPS trolley, 700 x 350 → Page 346	
Control console, SysLink	195764
EduTrainer Universal → Pages 338 – 341	

Recommended accessories:

Simulation box, digital	170643
Workpiece set "Cylinder end caps"	162240
Hydraulic power pack with a constant-displacement pump, 230 V	152962
Hydraulic oil (DIN 51524), HLP22, 10 Litres	192215
2x Hose line with quick release couplings, 1500 mm	159386
Aluminium profile plate, 700 x 350 mm	162386

#### Technical data

- Operating pressure hydraulics  
6 MPa (60 bar)
- Operating pressure pneumatics  
600 kPa (6 bar)
- Power supply 24 V DC
- 8 digital inputs
- 8 digital outputs

#### Training aims for project work

Mechanical:

- Mechanical set-up of a station
- Hydraulics:
- Set-up of a hydraulic control system
- Commissioning a rapid traverse feed circuit

Pneumatics:

- Installation of tubing for pneumatic components
- Application of pneumatic linear drives

Electrical:

- Correct wiring of electrical components

Sensors:

- Application of inductive and optical sensors
- Application of pressure switches

PLC:

- Programming and application of a PLC
- Structure of a PLC program
- Programming of operating modes

Troubleshooting:

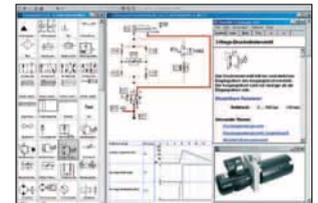
- Systematic troubleshooting in a production system

#### Recommended training media

- WBT Hydraulics



- WBT Electrohydraulics
- Mechatronics Assistant
- CIROS®
- Design and simulation program FluidSIM® Hydraulics



- Textbook Hydraulics, Basic level
- Textbook Programmable logic controllers, Basic level



#### Hydraulic punch station

The Hydraulic punch module consists of a hydraulic cylinder (diameter 32) with guides that punches the hole in the end cap of a workpiece for assembly. The moving part is protected against manual intervention via plexiglass.

Order no.	162352
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#### Stacking magazine module (end caps)

Separation of the cylinder caps for assembly. This module cannot be used for separation of symbolic workpieces or the body.

Order no.	162353
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# Separating station

## Flexibility



### Function

The Separating station differentiates workpieces based on their drilled hole depth and separates them into two different material flow directions.

Workpieces placed on the conveyor are transported to the depth measurement point. An analogue diffuse sensor checks the drilled hole depth. Workpieces of the type “cylinder body” (deep hole) are transported to the end of the conveyor. Workpieces of the type “housing” (shallower hole) are directed towards the rear via the second conveyor using a pneumatic branching gate with rotary drive. Fibre-optic through beam sensors with optical sensors monitor the material flow on the conveyors.

The Separating station can be supplemented with MPS® downstream stations in two directions.

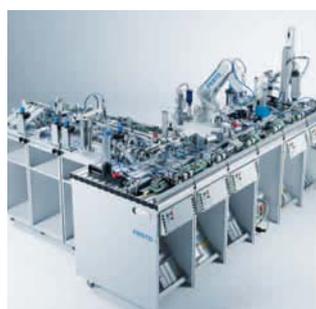
### Analogue and digital

The diffuse sensor supplies both an analogue and a binary output signal. This facilitates different training levels. The binary switching output can be adapted to the measurement requirement by means of a simple teach-in stage.

### Flexible assembly

The Separating station permits the creation of flexible assembly lines using MPS® stations. Combined assembly processes such as cylinder assembly and assembly of workpiece inserts in the housing can be realised using the Separating station.

[X]



Separating station, mounted	540719
Kit Separating station	548674

Additional equipment, also order:

MPS trolley, 700 x 350 → Page 346	
Control console, SysLink	195764
EduTrainer Universal → Pages 338 – 341	

Recommended accessories:

Simulation box, digital/analogue	526863
Workpiece set "Cylinder bodies"	167021
Workpiece set "Housings"	534619
Workpiece insert "Clock"	534621
Workpiece insert "Thermometer"	534622
Workpiece insert "Hygrometer"	534623

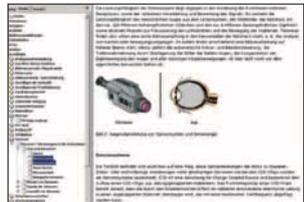
**Technical data**

- Operating pressure 600 kPa (6 bar)
- Power supply 24 V DC
- 8 digital inputs
- 5 digital outputs
- 1 analogue input

**Training aims for project work**

- Mechanical:
- Mechanical set-up of a station
- Sensor technology:
- Mode of operation and applications of analogue sensors
  - Application of optical sensors
- Pneumatics:
- Installation of tubing for pneumatic components
  - Pneumatic rotary drives
- Electrical and electronic:
- Connection of DC motors
- PLC:
- Programming and application of a PLC
  - Programming of alternative (OR) branches
  - Analogue signal processing

**Recommended training media**

- WBT Electrical engineering 1
- 
- Mechatronics Assistant
- 
- Design and simulation program FluidSIM® Pneumatics



**Diffuse sensor, analogue**

The optical sensor comes complete with holder for mounting on the guide rail profile of the conveyor. Measuring range 0 – 30 mm with analogue output 0 – 10 V and PNP switching output. The switching output can be freely adjusted via a teach-in process. Supplied complete with connecting cable.

Order no.	541120
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**Sorting gate/separator module, pneumatic**

For mounting on a conveyor. Complete with one rotary cylinder and mounting accessories.

Order no.	534367
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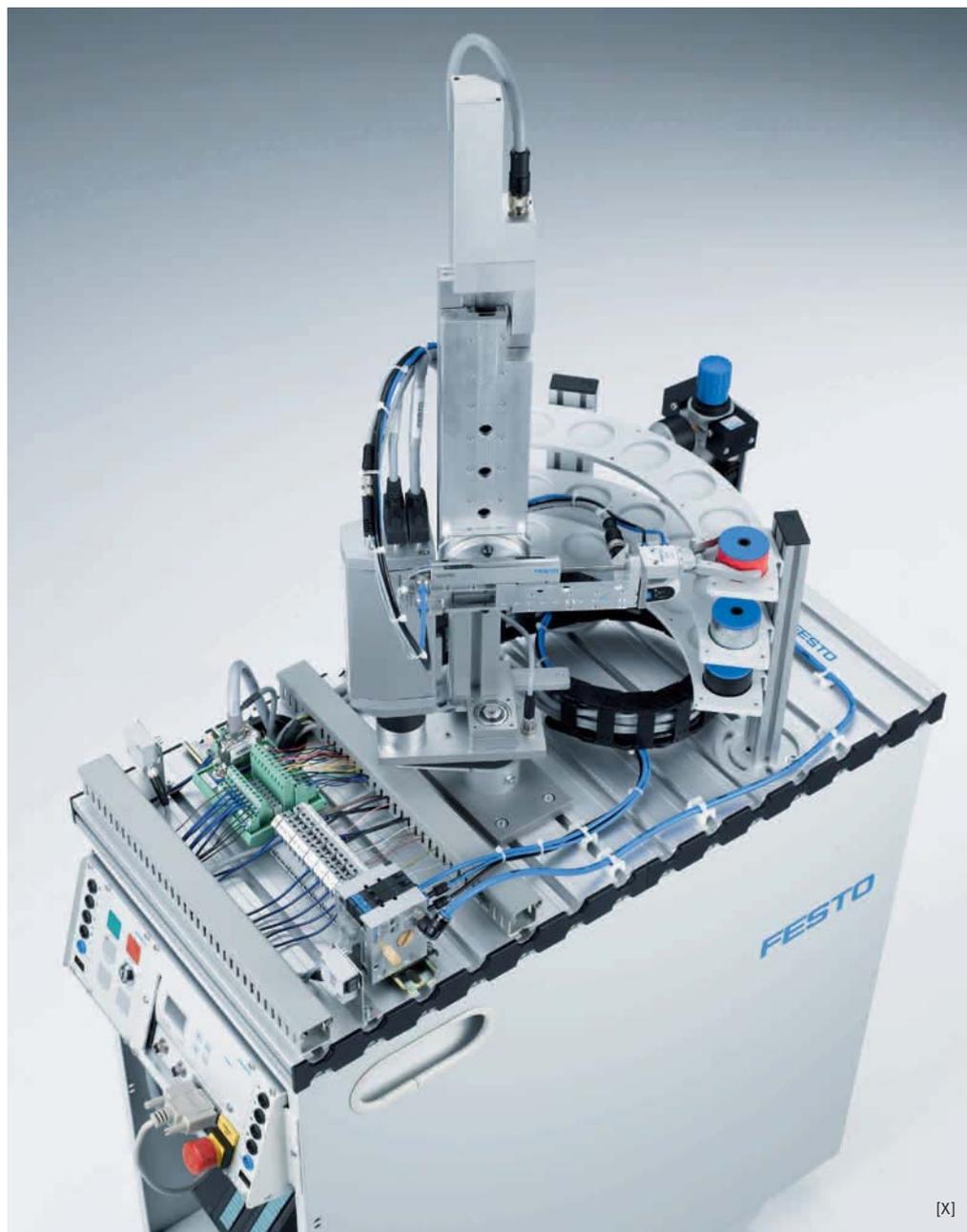
**Starting current limiter**

The starting current limiter contains a relay and an electronic start-up current limiting circuit. It can be mounted on a DIN rail. Electrical connection is by means of screw terminals.

Order no.	150768
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# Storing station

## In and out, electrically



### Function

The Storing station places workpieces in and takes workpieces out of storage. The station is equipped with three storage levels, with a level each for six red, six silver and six black workpieces. The workpieces are gripped using a pneumatic gripper. The linear movement is executed using a linear cylinder. The rotary movement is performed by an electrical servo drive with integrated controller. The stroke movement is executed using an electrical linear axis with separate controller.

During placement into storage, a workpiece inserted in the Holder module is detected using the colour sensor. The workpiece is placed in the next free compartment in the corresponding storage level based on the colour. Upon removal from storage, the workpieces are transported from the shelf compartments to the downstream station.

The Storing station can be employed as the first station or the last station in an MPS® combination.

### Electrical drives

The latest drive technology for a challenging lesson: with the MTR-DCI, the motor, gear, power electronics and positioning controller form a compact unit for optimum positioning of the rotation axis. The electrical mini slide SLTE with motor controller SFC-DC ensures a correctly regulated drive for horizontal positioning.

### Colour-friendly!

The tiny colour sensor detects the workpieces using an integrated white light source. It learns new colours easily by means of teach-in and activates one of the three switching outputs when one of these is detected.

[X]



Storage station, mounted	541113
Kit Storage station	548673

Additional equipment, also order:

MPS trolley, 700 x 350 → Page 346	
Control console, SysLink	195764
EduTrainer Universal → Pages 338 – 341	

Recommended accessories:

Simulation box, digital/analogue	526863
Workpiece set “Cylinder bodies”	167021

**Technical data**

- Operating pressure 600 kPa (6 bar)
- Power supply 24 V DC
- 8 digital inputs
- 8 digital outputs

**Training aims for project work**

- Mechanical:
  - Mechanical set-up of a station
- Sensor technology:
  - Application of colour sensors
  - Application of limit switches
- Pneumatics:
  - Installation of tubing for pneumatic components
  - Pneumatic grippers
  - Pneumatic linear drives
- Drive technology:
  - Configuration and parameterisation of electrical drives
  - Application of drive controllers
  - Reference travel
  - Adjustment of speed and acceleration profiles
  - Teaching of positions

PLC:

- I/O actuation of drive controllers
- Commissioning:
  - Commissioning of electrical axes

**Recommended training media**

- WBT Electric drives 1



- Mechatronics Assistant
- Design and simulation program FluidSIM® Pneumatics

**Electrical mini slide SLTE**

Supplied complete with DC motor with integrated encoder, stroke 150 mm. The motor controller SFC-DC is required for activation.



Order no. 537465

**Motor controller SFC-DC**

Positioning controller for electrical mini slide SLTE, with control interface (7 digital inputs, 4 digital outputs), 24 V DC load and logic power supply, RS232 interface for commissioning, FCT software, display with four buttons so that all settings for commissioning and diagnosis can also be made directly.



Order no. 538913

**Also order:**

- 538914 Supply cable
- 538919 Control cable
- 538917 Motor cable
- 537926 RS232 cable

**Servo motor MTR-DCI**

Compact DC motor with integrated controller and control interface (7 digital inputs, 4 digital outputs), 24 V DC power supply, RS232 interface for commissioning, FCT software, display with four buttons so that all settings for commissioning and diagnosis can also be made directly.



Order no. 696719

**Also order:**

- 537931 Supply cable
- 537923 Control cable
- 537926 RS232 cable

**Colour sensor**

Three independent channels with teach-in capability, sensing range 12 – 32 mm, 24 V DC operating voltage, 3 outputs (PNP, N, O).



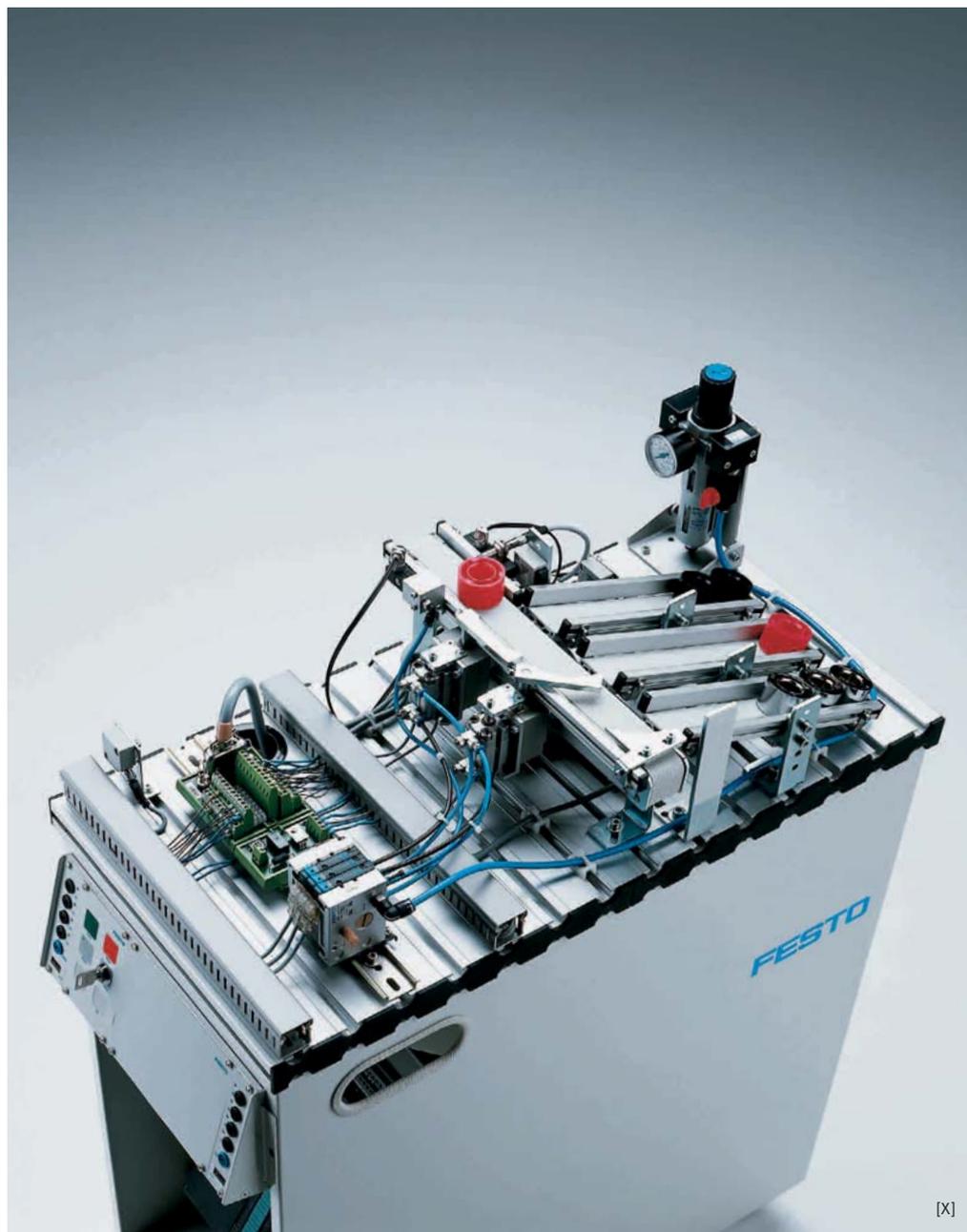
Order no. 538236

**Also order:**

- 525616 Connecting cable

# Sorting station

## Finally



### Function

The Sorting station sorts workpieces onto three slides. Workpieces placed on the start of the conveyor are detected by a diffuse sensor. Sensors upstream of the stopper detect the workpiece features (black, red, metal). Sorting gates actuated by short-stroke cylinders via a deflector allow sorting of workpieces onto the appropriate slides. A retro-reflective sensor monitors the level of the slides.

### Topic:

#### Material detection

Inductive and optical sensors detect the colour and material of workpieces. Short-stroke cylinders stop workpieces on the conveyor and pass them on for sorting onto one of three slides.

### For project work:

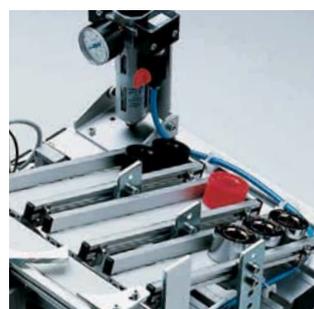
#### Upgrades from the modular conveyor system

All modules and components used in this station are part of the modular conveyor system, for example:

- Sorting gates with short-stroke cylinder
- Sensors
- Guide rails
- Conveyor motor

Its great modularity makes the Sorting station particularly suited for project work.

[X]



Sorting station, mounted	195786
Kit Sorting station	526886

Additional equipment, also order:

MPS trolley, 700 x 350 → Page 346	
Control console, SysLink	195764
EduTrainer Universal → Pages 338 – 341	

Recommended accessories:

Simulation box, digital	170643
Workpiece set “Cylinder bodies”	167021
Workpiece set “For cylinder assembly”	162239

**Technical data**

- Operating pressure 600 kPa (6 bar)
- Power supply 24 V DC
- 8 digital inputs
- 4 digital outputs

**Training aims for project work**

Mechanical:

- Mechanical set-up of a station
- Selection and application of various electrical drives

Pneumatics:

- Installation of tubing for pneumatic components

Electrical:

- Correct wiring of electrical components

Sensors:

- Correct application of limit switches
- Mode of operation and applications of optical and inductive sensors

PLC:

- Programming and application of a PLC
- Programming of alternative (OR) branches

Commissioning:

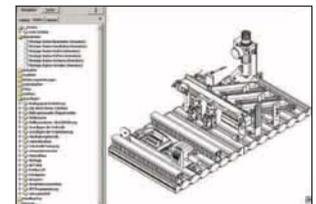
- Commissioning of the entire sequence

**Recommended training media**

- WBT Sensor technology 2



- Mechatronics Assistant



- Training documents Sorting station
- Textbook Programmable logic controllers, Basic level
- Textbook Proximity sensors
- Virtual process environment CIROS®



**Sorting gate module, pneumatic**

For mounting on a conveyor. Complete with one double-acting short-stroke cylinder, two sensors for end-position sensing and mounting accessories.

Order no.	526230
-----------	--------



**Stopper module**

For mounting on a guide rail (conveyor or slide). Complete with one single-acting short-stroke cylinder and mounting accessories.

Order no.	196971
-----------	--------



**Retro-reflective sensor**

The optical sensor and the reflector come complete with brackets for mounting on a profile or profile plate.

Order no.	196969
-----------	--------



**Inductive sensor**

The inductive sensor comes complete with holder for mounting on the guide rail profile of the conveyor or a slide.

Order no.	196968
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## Either: Simply build it yourself



Each MPS® station is supplied fully assembled and tested on the profile plate. For efficient operation, we recommend:

- MPS® trolley with lockable castors. This simplifies project work and accommodates the newly designed control console and an EduTrainer® Universal, size 1
- Control console with membrane keyboard
- EduTrainer® Universal

Alternatively, the stations can also be operated without the trolley – and can even be controlled with electrical signal input units and the EduTrainer® from the training packages.

### Simply commission it:

- Attach the control console to the trolley with two bolts
- Insert the EduTrainer® Universal into the trolley
- Connect the EduTrainer® Universal to the control console and the station using our universal SysLink connector
- ... and you're ready to go!

On request, we can also commission systems for you – particularly in the case of larger systems.

## Or: MPS® commissioning service



To ensure that your training projects run smoothly right from the start, our service technicians offer:

### 1. Complete commissioning of your new system:

- Mechanical and electrical connection of station, trolley, control console and EduTrainer® Universal
- Adjustment of all electrical, pneumatic and mechanical components
- Configuration of controllers and loading of programs

### 2. Instruction in:

- Technical documentation and Mechatronics Assistant
- Program structures
- Lesson preparation using the Mechatronics Assistant

And if you wish ...

### 3. Useful tips on how to get the most from the MPS®:

- Applications
- Enhancements
- Seminars

### Commissioning packages

- MPS® Start-Up Basic SP1: For MPS® stations, without Robot, Assembly, Hydraulics. Order no. 539111
- MPS® Start-Up Robotics SP2: For MPS® stations Robot, Assembly, Hydraulics. Order no. 540705
- MPS® Start-Up Networking SP3: Profibus networking. Order no. 540706

SP 1	539111
SP 2	540705
SP 3	540706

# Mechatronics Assistant Version 2

## The multimedia tool for training at school and at work

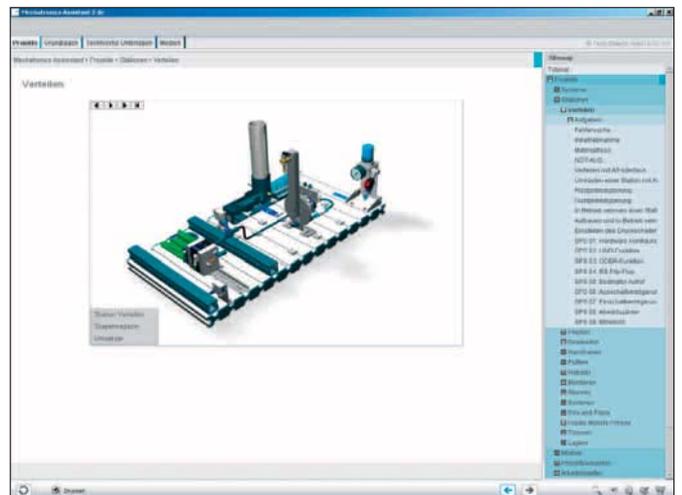
- Structured archive on DVD with complete documentation
- For project work, as well as for training and preparation for tests
- For all training-related areas in the field of automation technology
- For teachers and learners: structure and content have been organised in such a way that trainees can work independently with the Mechatronics Assistant on any given task.

## Content

- Practice and topic related range of tasks with solutions
- Graphics, photos, animations, videos sequences, presentations
- Manuals, operating instructions, data sheets and circuit diagrams
- Additional teaching aids and complete technical documentation, as well as lots of tips for working with MPS®

## Your advantages

- Training with MPS® can begin immediately with **ready-to-use tasks** involving modules, stations and systems.
- **Various degrees of difficulty for different levels of learning:** from introductory tasks to complex projects
- **Create your own archive:** all tasks can be easily modified and saved as individualised assignments.
- **Format documents to suit your individual needs** and reuse them: many of the documents included with the Mechatronics Assistant are available in source format (e.g. doc, ppt, dxf).
- Supplementary information and **cross-references can be accessed quickly by means of hyperlinks.**
- The **high-performance full text search function** retrieves content as required. Graphics, animations and videos are also linked to keywords and can be retrieved using the search function.
- **Always the latest thanks to free updates:** you can download updates, new tasks, sample programmes and project ideas free of charge. Your Mechatronics Assistant develops as your knowledge increases: [www.festo-didactic.com](http://www.festo-didactic.com)

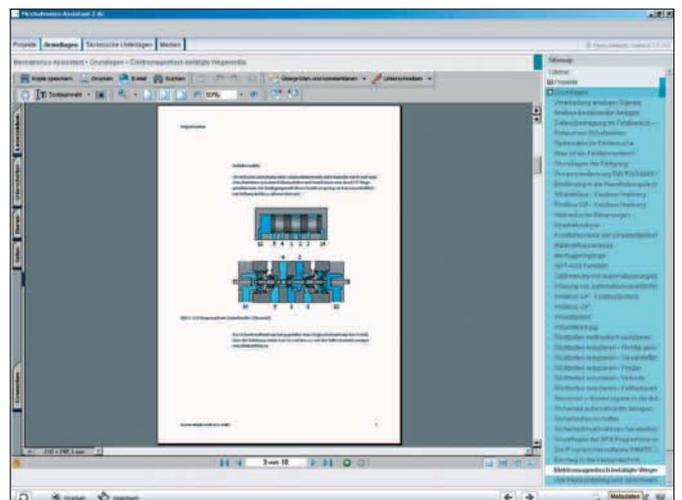


## Note

- Multiple licences for local or network installations with any desired number of licences, with online activation or dongle
- Can be installed in German, English or Spanish, as well as other languages upon request
- Shipped on DVD in Systainer

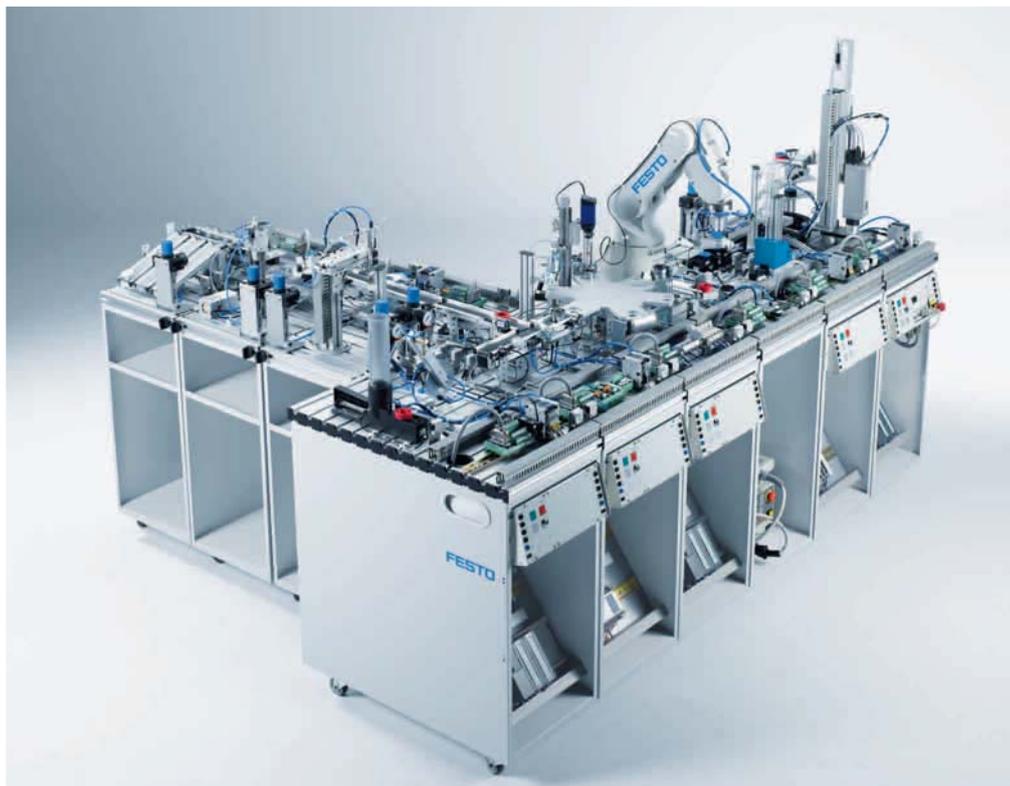
## System requirements

- PC with Win XP/Vista/Windows 7
- Flash Player
- Microsoft Office
- Acrobat Reader
- DXF viewer
- Sound card
- DVD drive
- Screen resolution: Min. 1024 x 768



x-Licence with online activation de/en/es/fr	563358
x-Licence with network licence connector de/en/es/fr	563359
Mechatronics Assistant Update 1.0 – 2.0	
6 licences with online activation de/en/es/fr	562483
6 licences with network licence connector de/en/es/fr	562482

# Combining stations



A new interface concept that offers many possibilities for direct combination of individual stations. Various aspects determine the decision as to which combination is required:

- Training aims
- Supplementation of existing stations
- Budget

The complete systems MPS® 200 section gives an overview of the most popular combinations.

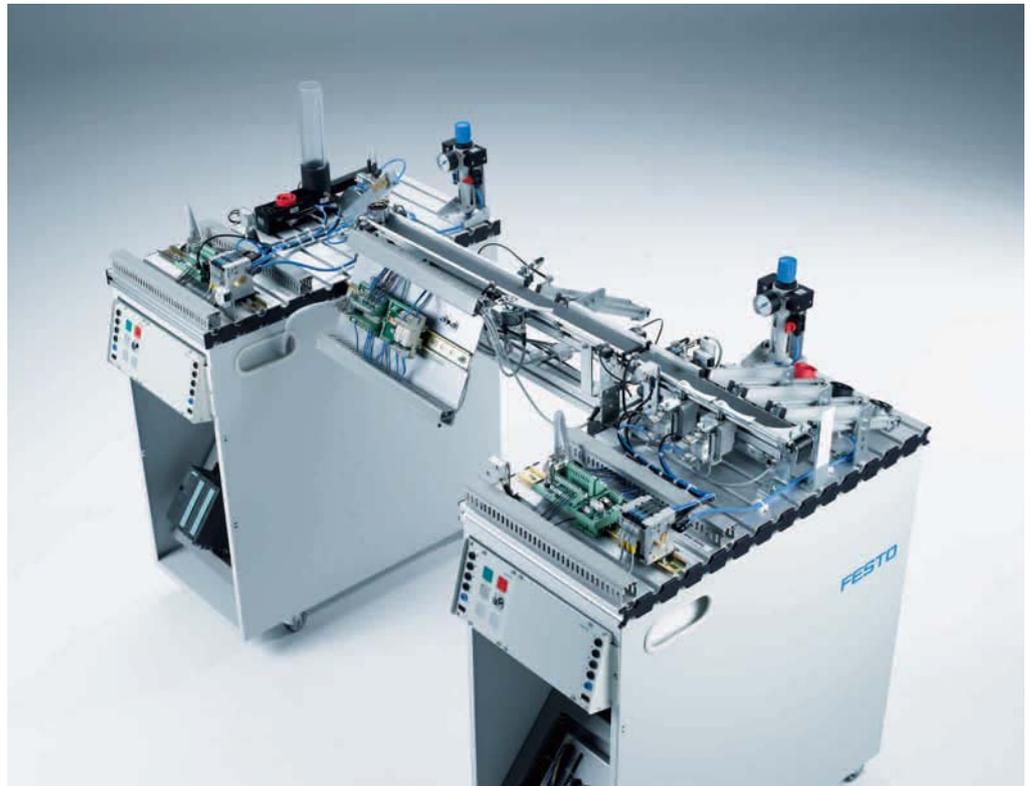
Distributing → separating → processing → robot → assembly → storing  
 └── Pick&place → fluidic muscle press → sorting

**MPS® stations can be combined as follows:**

Stations	Possible direct downstream stations					
	Testing	Processing	Handling, pneumatic/electrical	Distributing/ Conveyor	Pick&Place	Fluidic muscle press
Distributing	+			+	+	
Testing		+	+	+	+	
Processing			+	+	+	
Handling, pneumatic/electrical				+	+	+
Distributing/Conveyor		+	+		+	+
Pick&Place			+	+		
Fluidic muscle press				+		
Robot				+		
Assembly/Assembly with punching*			+	+		
Separating**		+	+	+	+	
Storing				+	+	

**Combination using a conveyor**

The conveyor enables all MPS® stations to be interconnected. The conveyor is simply mounted between two stations as the linking element. This facilitates the set-up of customised training arrangements.



Distributing → conveyor → sorting

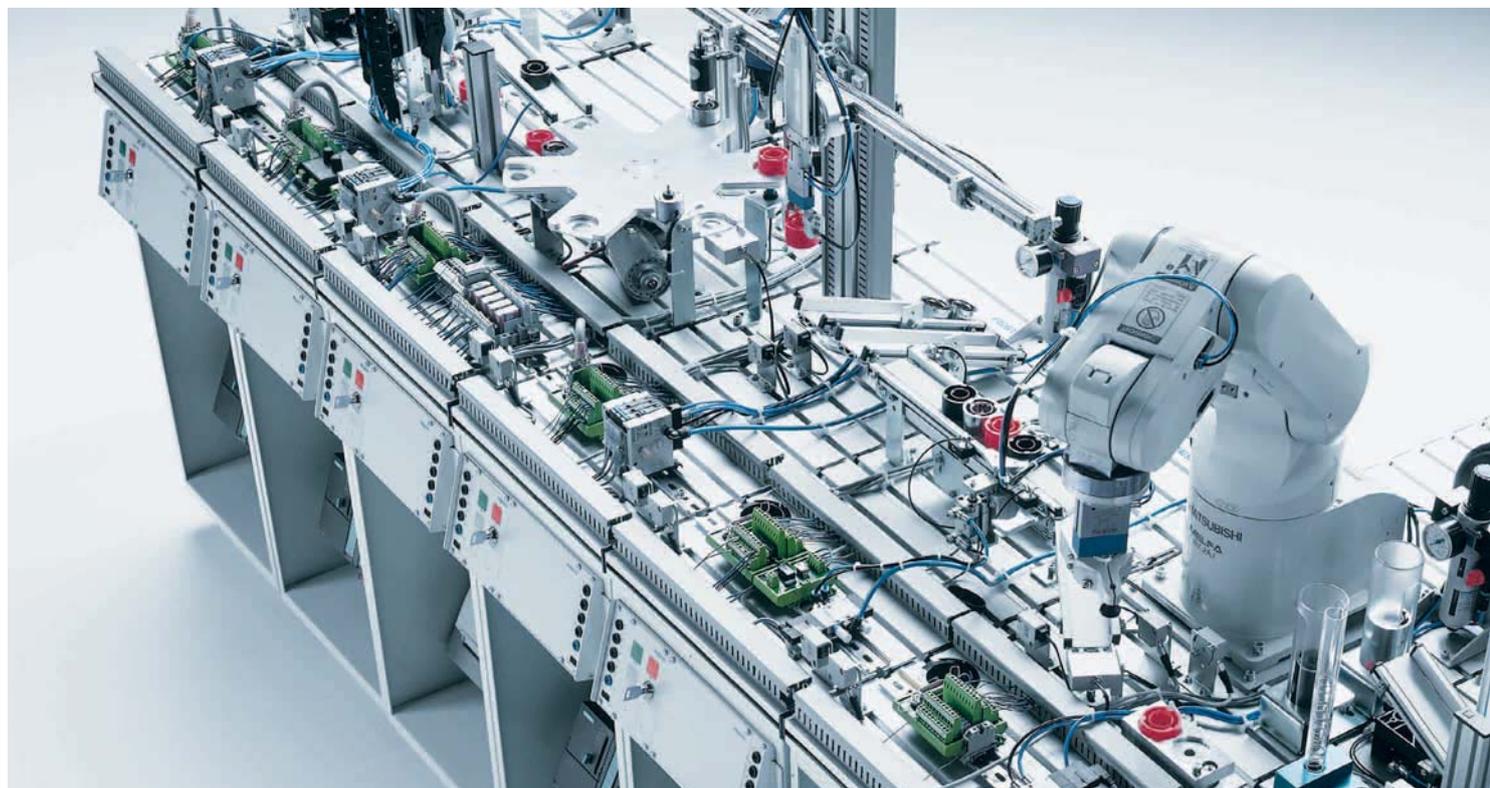
Robot	Assembly/Assembly with punching*	Separating**	Storing	Sorting
		+		+
+		+	+	+
+		+	+	+
		+		+
+		+	+	+
+			+	+
+			+	+
	+			
+			+	+
			+	+
+		+		+

\* The Punching station can be used to upgrade the Robot station.

\*\* The Separating station can be combined with two downstream stations placed at right angles.

## MPS® 200 complete systems

With blended learning package and modular expansion options



### Complete from A to Z

MPS® 200 systems come with all the required accessories, guaranteeing effective training from the very start. They range from small complete systems to entire mechatronic laboratory outfits.

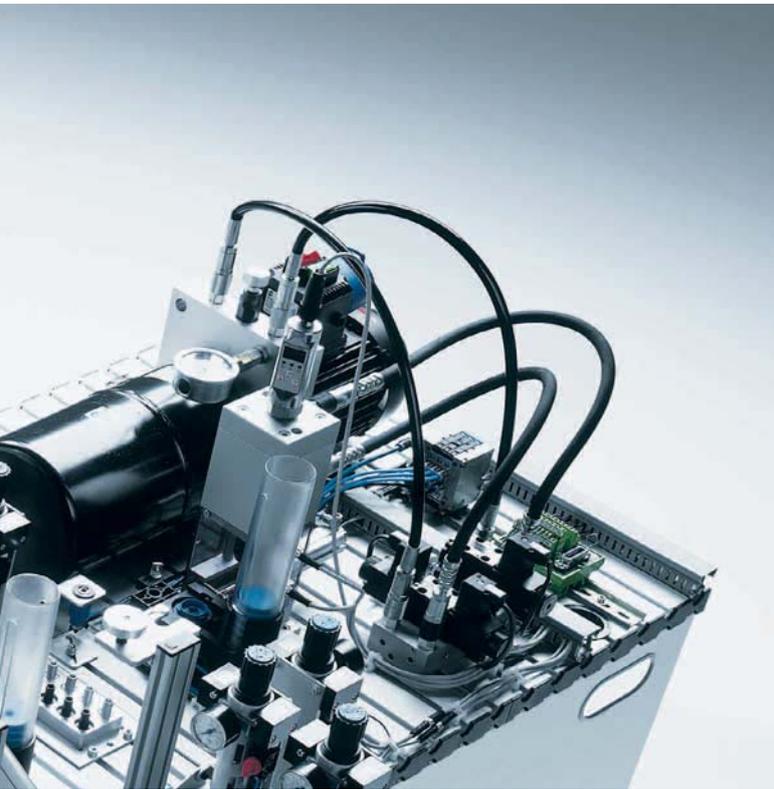
- MPS® stations
- All necessary accessories such as trolleys, power supply units, control console, workpiece set, etc.
- Control package with programming software and cable
- Visualisation and simulation software

The new interface concept offers many possibilities for direct combination of individual stations. Various aspects determine the decision for this combination or that:

- Training content
- Supplementation of existing stations
- Budget



**MPS® 202-Mechatronics**  
**Small but complete**  
Distributing, Sorting



**Flexibly expandable**

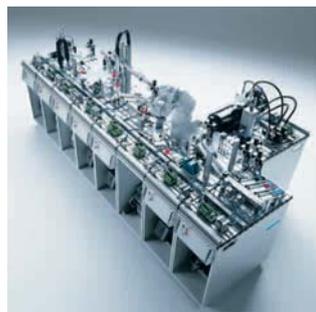
Of course you can also gradually expand your MPS® 200 system with stations, modules and components or with additional web-based training programs.

**Blended learning package included**

Each MPS® 200 system includes a package of web-based training programs as well as FluidSIM® Pneumatic and Mechatronics Assistant, the tool for professional training. Some packages include CIROS® Programming and CIROS® Education.

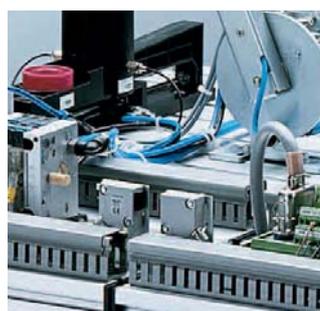
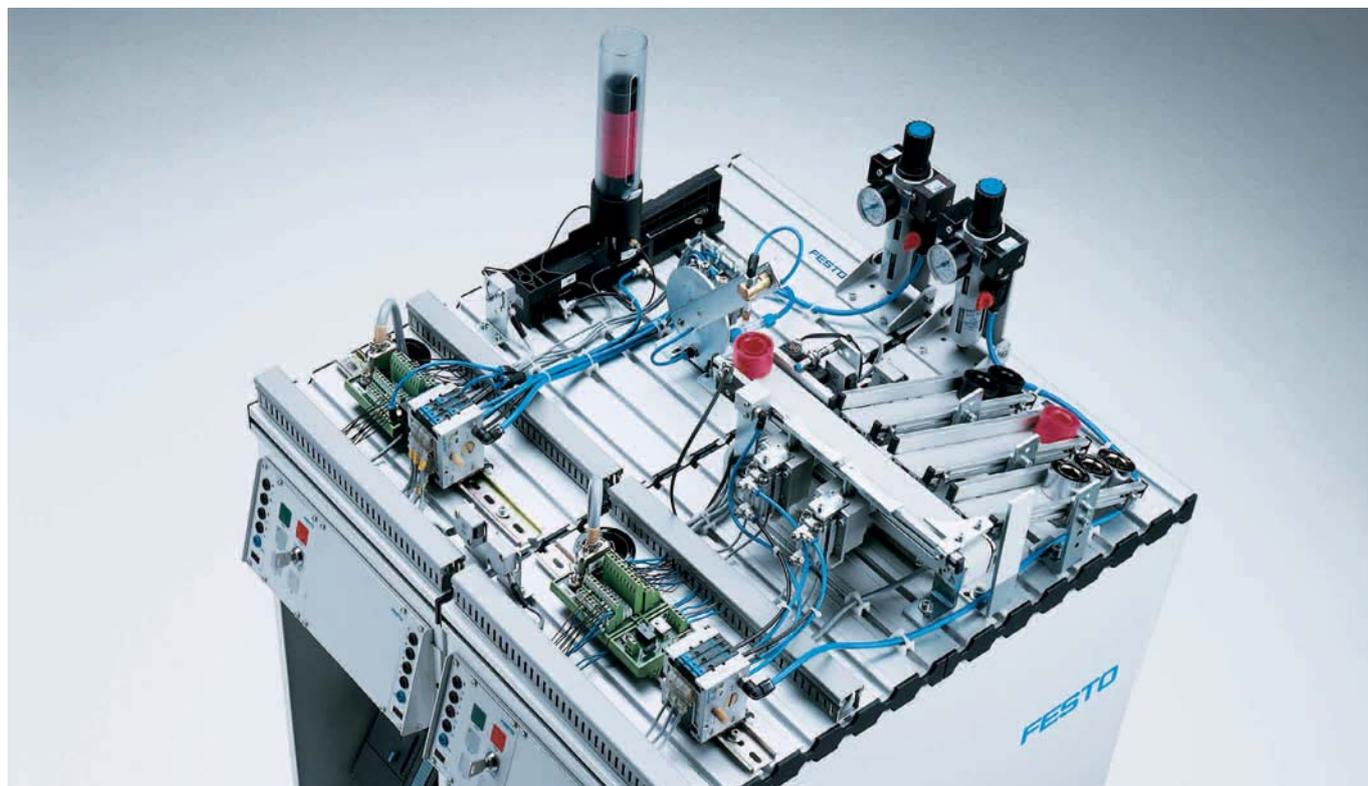


**MPS® 203-Fieldbus**  
**Mechatronics and fieldbus technology**  
 Distributing with AS-interface,  
 Testing, Sorting with Profibus DP



**MPS® 210-Mechatronics**  
**The all-rounder**  
 Distributing, Testing, Processing,  
 Handling, Buffering, Assembly with  
 robots, Punching, Sorting

## MPS® 202-Mechatronics – Small but complete ...



### Simple communication

A station can only pass on a work-piece to the next station if it is ready to process it. In the MPS®, this “OK” signal is provided via optical sensors. This makes it very easy to combine stations.



### Alternatively enhanced I/O communication

The stations can also be networked via I/Os. We have routed the necessary input and output signals to 4 mm safety sockets to facilitate this communication. The corresponding exercises and worksheets can be found in the Mechatronics Assistant.



### Controlling, simulating and programming with EasyPort

No matter which control package you choose the scope of delivery always includes EasyPort, the universal interface for getting started with blended learning.



### Then there's FluidSIM®

Simply start FluidSIM and the integrated Soft Logo! takes over control of a station or the entire system. Getting started with programming has never been so easy.

## ... with blended learning package, FluidSIM®, Mechatronics Assistant and web-based training programs

Complete MPS 202 system with Simatic S7-300 control package	541161
Complete MPS 202 system with Festo CPX-CEC control package	541162
Complete MPS 202 system with Allen Bradley ML 1500 control package	541163
Complete MPS 202 system with Mitsubishi MELSEC control package	541164

### PLC control packages include:

#### SIMATIC S7-300

2x EduTrainer® Universal with SIMATIC S7-313C-2DP, 1x programming cable, 1x programming software STEP 7 Professional for Training

#### Festo CPX-CEC

2x EduTrainer® Universal with CPX-CEC, 1x programming cable, 1x programming software CoDeSys

#### Allen Bradley ML 1500

2x EduTrainer® Universal with Micro Logix 1500, 1x programming cable, 1x programming software RS-Logix 500 Starter

#### Mitsubishi MELSEC

2x EduTrainer® Universal with FX1N, 1x programming cable, 1x programming software GX IEC Developer FX

### The MPS® 202-Mechatronics system contains everything you need for training:

#### Stations

Distributing, Sorting

#### Accessories

2x trolley, 2x power supply unit, 2x control console, 1x workpiece set, 1x SimuBox

#### Control technology

1x PLC control package, 1x EasyPort

#### Software

1x FluidSIM® P, 1x Mechatronics Assistant, 1x Discover MPS® 200 web-based training program, 1x LOGO! Training web-based training program

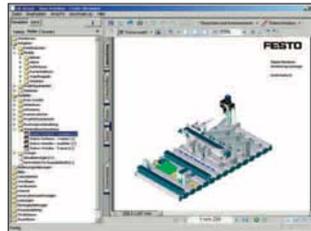
### Function

The Stacking magazine module separates workpieces. The Changer module transports the individual workpieces to the sorting conveyor by means of its vacuum gripper. Optical and inductive sensors differentiate the workpieces based on material and colour. Pneumatic branching gates then sort the workpieces onto three different slides.

### Training aims

- Mechanical set-up of a station
- Installation of tubing for pneumatic components
- Vacuum technology
- Pneumatic linear and rotary drives
- Application of simulation tools
- Correct wiring of electrical components

- Correct application of limit switches
- Mode of operation and applications of optical and inductive sensors
- Logic programming
- Programming and application of a PLC
- Structure of a PLC program
- Programming of alternative branches
- Programming of an operating mode part
- Set-up and optimisation of material flow
- Optimisation of setting-up times
- Linking of stations
- Simple communication
- Material flow control
- Enhanced I/O communication
- Commissioning of complex systems



### Mechatronics Assistant

#### Professional Training –

#### Successful training with MPS®

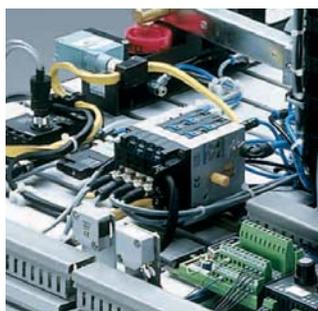
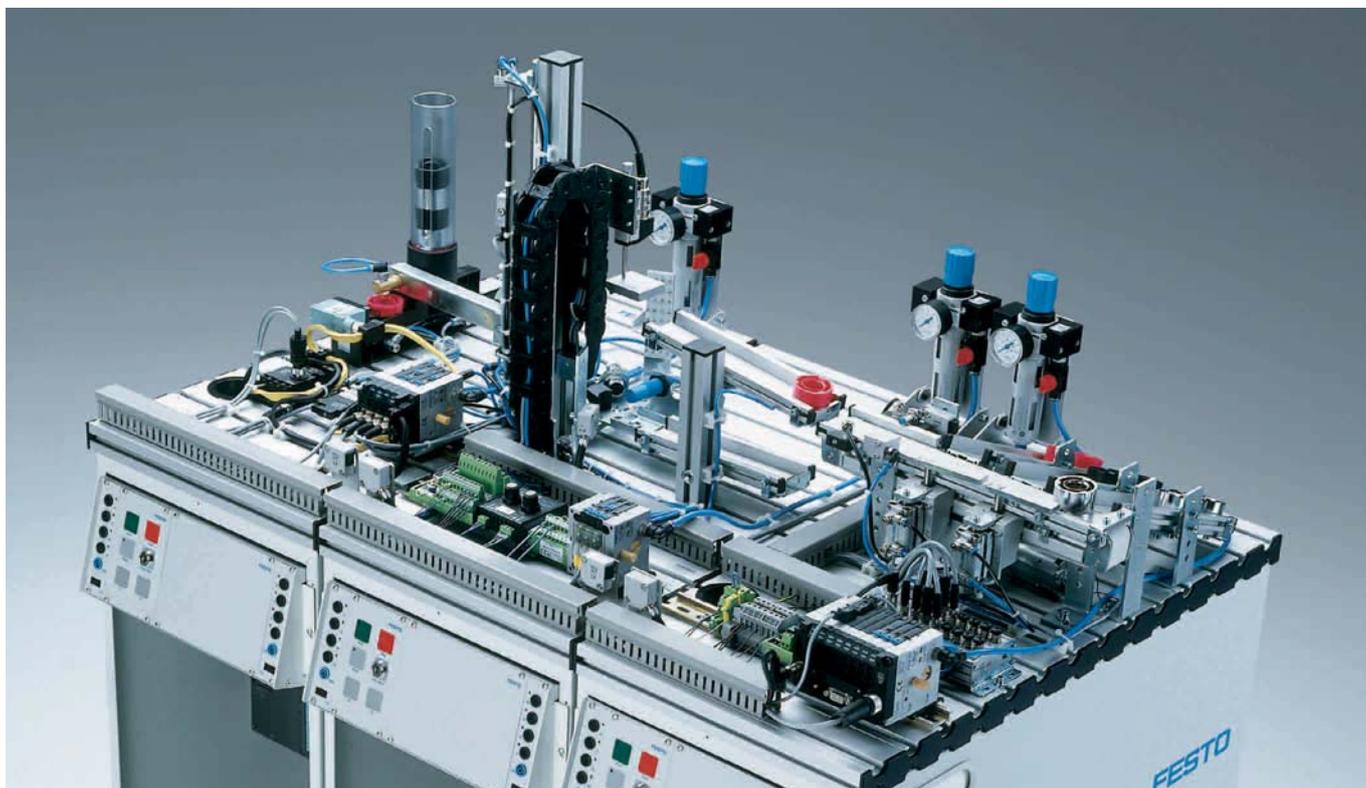
With more than 2,000 pages of lesson material on the two stations, the system can be used in lessons straight from the box. Also provided are exercises on modules, stations and all related topics such as circuit diagram creation, PLC programming and a full set of documentation for the trainer.

All the exercises can be modified, extended and archived, making the Mechatronics Assistant the tool for professional training methods.

### Getting started with MPS® 202 – a multi-media experience

The Discover MPS® 200 web-based training program takes your trainees on a voyage of discovery – in their own home, in the laboratory or in any other location that suits them.

# MPS® 203-Fieldbus – Mechatronics and fieldbus technology ...



**Innovative valve technology:**  
**AS-interface CP valve terminal**  
The Distributing station with AS-interface uses a wide range of AS-interface slaves. A typical example of an AS-interface component is the optical sensor with integrated AS-interface.

**Topic: Profibus DP**  
The Sorting station features a Profibus DP valve terminal. All the sensors are connected to the input module of the valve terminal via plug connectors.

**Visualisation**  
A complete visualisation application for the Distributing, Testing and Sorting stations as well as guided exercises on autonomous creation of visualisation applications can be used in lessons without any advance preparation.

**Professional tool: SIMATIC WinCC**  
The professional control and monitoring system for planning and realising visualisation. This renders the exchange of data with the SIMATIC controllers of the MPS® stations particularly effective.

# ... with visualisation package and the Mechatronics Assistant

Complete MPS 203-Fieldbus system

541165

**PLC control package includes:**

**SIMATIC S7-300**

3x EduTrainer® Universal with SIMATIC S7-313C-2DP, 1x AS-interface expansion for S7-300 EduTrainer® Universal, 1x programming cable, 1x programming software STEP 7 Professional for Training, 1x AS-interface addressing device, 1x AS-interface addressing cable

**The MPS® 203-Fieldbus system contains everything you need for training:**

**Stations**

Distributing with AS-interface, Testing, Sorting with Profibus DP

**Accessories**

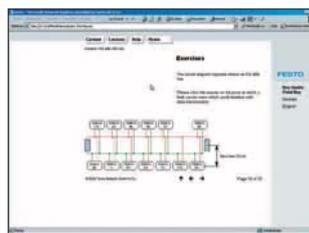
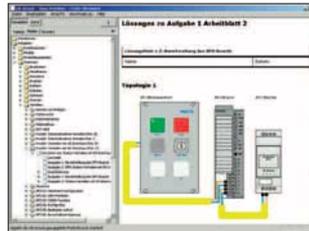
3x trolley, 3x power supply unit, 2x control console, 1x control console with AS-interface, 1x workpiece set, 1x SimuBox

**Control technology**

1x PLC control package

**Software**

1x WinCC Trainer Package for visualisation software, 1x Mechatronics Assistant, 1x Discover MPS® 200 web-based training program, 1x Fieldbus technology web-based training program



**Project exercises on fieldbus and visualisation technology**

The Mechatronics Assistant comes with more than 500 pages of exercises and solutions for lessons on fieldbus technology.

**The web-based training program on the system**

The multi-media web-based training program provides students with a quick introduction to the special features of the MPS® 203-Fieldbus system. This makes preparation extremely convenient since it can be carried out anywhere and also extremely efficient since students can complete the various chapters of the training program as it suits them and their personal rate of learning.

**Function**

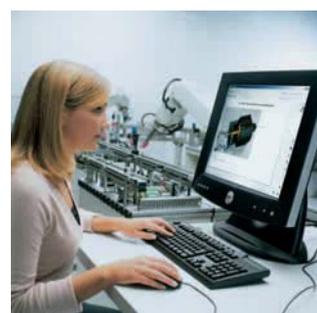
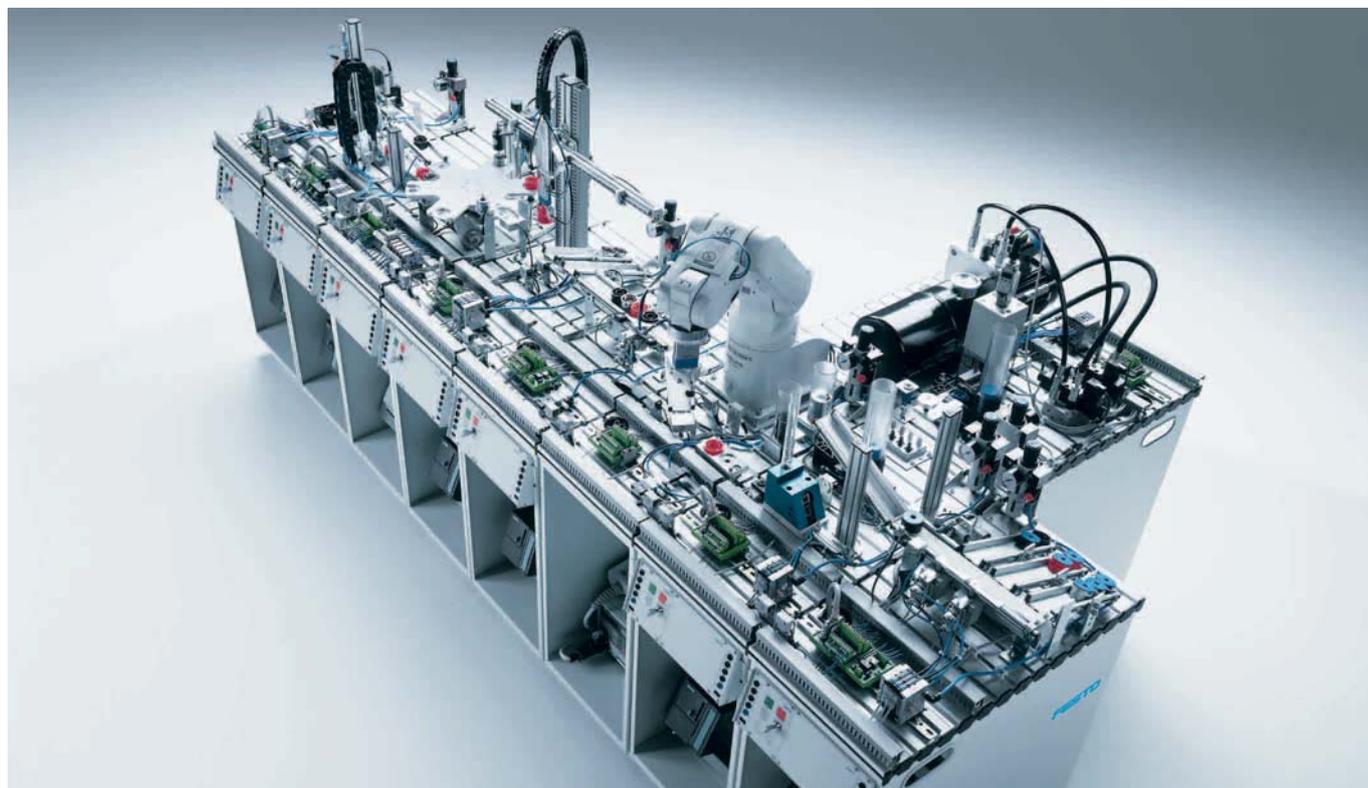
The Distributing station separates workpieces from the Stacking magazine and moves them to the Testing station. The Testing station checks the workpiece height. The Sorting station then sorts the workpieces according to material and colour onto three slides.

**Training aims**

- Mechanical set-up of a station
- Installation of tubing for pneumatic components
- Vacuum technology
- Pneumatic linear and rotary drives
- Fieldbus technology
- Information technology
- Testing, integration and commissioning of AS-i components in an automated system

- Planning, configuration and programming of AS-i networks
- Testing, integration and commissioning of Profibus DP components in an automated system
- Planning, configuration and programming of Profibus DP networks
- Linking of stations
- Simple communication
- Enhanced I/O communication
- Networking of stations with Profibus DP
- Planning, engineering, implementation, commissioning and execution of a visualisation application

## MPS® 210-Mechatronics – the all-rounder ...



### Complete

From mechanics, pneumatics, PLC technology, handling technology, electrical engineering, electronics to robotics and hydraulics, each station facilitates interesting exercises on automation and mechatronics. The MPS® 210 system is particularly suited to the areas of handling, PLC and robot technology due to its close industrial orientation.

### Exploit the full flexibility of MPS®

The combination of multiple MPS® stations offers training aims for many levels of experience and many different fields. The project kits of the MPS® 210 system facilitate the realisation of a wide range of different systems. Conveyor belts, integrated between the MPS® stations, facilitate a multitude of solutions for material flow.

### Successful realisation of project ideas

The MPS® 210 system contains all the components needed to realise a wide range of projects – giving your students a free hand in creativity!

### WBT support

The web-based training programs contained in the MPS® 210 system will help trainers prepare their students for project work. They deal with topics such as project planning, information acquisition or getting started with the MPS® 210 system.

## ... with an all-inclusive media package

Complete MPS 210 system with SIMATIC S7-300 control package	541172
Complete MPS 210 system with Festo CPX-CEC control package	541173
Complete MPS 210 system with Allen Bradley ML 1500 control package	541174
Complete MPS 210 system with Mitsubishi MELSEC control package	541175

### PLC control packages include:

#### SIMATIC S7-300

7x EduTrainer® Universal with SIMATIC S7-313C-2DP, 7x programming cable, 1x programming software STEP 7 Trainer Package

#### Festo CPX-CEC

7x EduTrainer® Universal with CPX-CEC, 7x programming cable, 7x Codesys®

#### Allen Bradley ML 1500

7x EduTrainer® Universal with Micro Logix 1500, 7x programming cable, 1x programming software RS-Logix 500 Starter

#### Mitsubishi MELSEC

7x EduTrainer® Universal with FX1N, 7x programming cable, 2x programming software GX IEC Developer FX Trainer Package

**Also order:** Hydraulic power unit

### The MPS® 210-Mechatronics system contains everything you need for training:

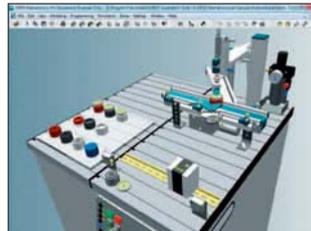
**Stations:** Distributing, Testing, Processing, Handling, Buffer, Robot with Assembly, Punching, Sorting

**Project kits:** 5x Distributing, 5x Conveyor

**Accessories:** 9x trolley, 8x control console, 5x SimuBox, 9x power supply unit, 5x workpiece set

**Control technology:** 1x PLC control package, 1x EMERGENCY-STOP board, 4x EMERGENCY-STOP control console, 5x EasyPort

**Software:** CIROS® Education licence for 12 users, FluidSIM® P licence for 6 users, 6x Mechatronics Assistant, 1x Discover MPS® 200 web-based training program, 1x LOGO! Training web-based training program, 1x Project Management web-based training program



### Simulating stations

CIROS® offers optimum preparation for a hands-on lesson. All the stations can be tested and programmed in simulation. Bugs can even be built into the model to permit an optimum, practical starting point for lessons.

CIROS® facilitates full or partial instruction in the use of robot stations through simulation. The simulation also offers robot cells featuring other robots such as Kuka and ABB for comprehensive robot training.

### Function

The complete assembly line produces a pneumatic cylinder made up of body, piston, springs and cap.

### Special training aims

- The system enables 15 – 30 students to be trained in mechatronics.
- The Distributing and Conveyor project kits (5 of each are included) provide an introduction to the project work.
- Actuation is performed via FluidSIM® and EasyPort or using a programmable logic controller.
- The system layout can be changed using the project kits. More than 30 different combinations can be created using the system.
- Production planning, reduction of set-up times, FMEA and TPM – the system offers solutions for the hot topics of production optimisation.

# MPS® 500-FMS

## Flexible production – compatible, modular and versatile



### Thought and action in networked systems

It is becoming more and more common for specialists and engineers to be responsible for operation and maintenance of complex automated production systems. This requires the seamless interaction of all the technologies involved.

MPS® 500-FMS forms the basis for general technological training using practical problems from actual operational applications. It provides the perfect platform for analysing, understanding and mastering the interaction of mechanics, pneumatics, electrical engineering, control technology and communication interfaces – all absolutely critical for proper and successful management of networked systems.



### The transport system

The transport facilities are a central component of automated production systems. The rectangular conveyor configuration of the FMF-F series offers all the characteristics of professional industrial systems:

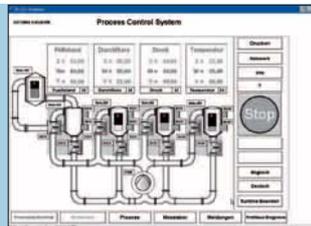
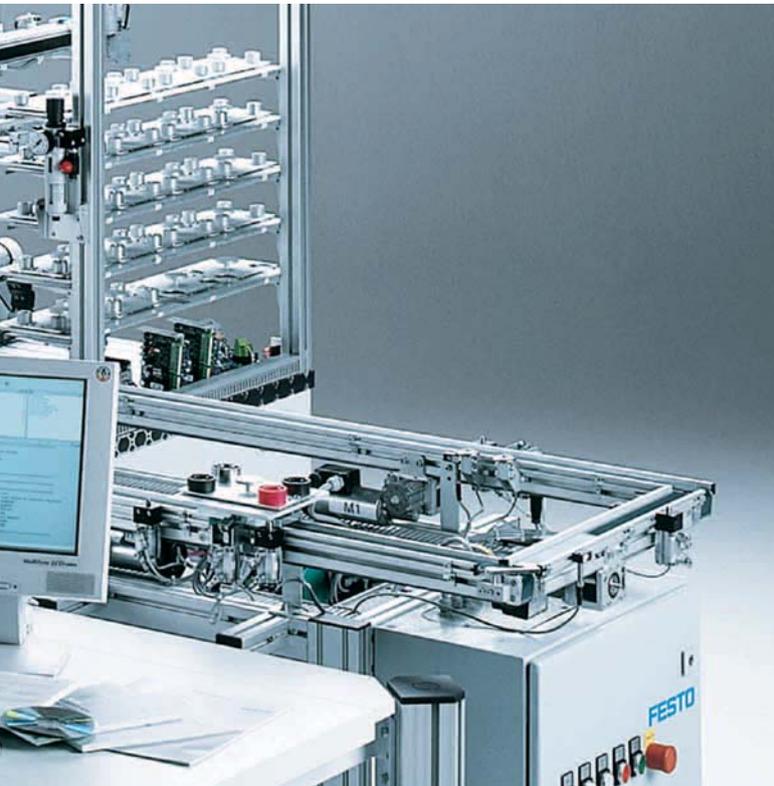
- 6 working positions
- Pallet identification
- Valve terminal technology
- AS-i fieldbus technology
- PLC control cabinet
- S7-300 PLC controller
- Frequency converter
- AC drive motors
- EMERGENCY-STOP
- I/O port for station
- Dimensions: 3000 x 500 mm



### The warehouse

Indispensable and technically challenging from a logistical point of view – automated warehouses facilitate flexible logistical concepts and short delivery times. The HRL20 offers all the functions of a full-size warehouse in a smaller format:

- Shelf with 5 x 4 locations
- Precision storage and retrieval robot – linear, X/Y/Z (DC/pn/DC)
- Positioning controller
- Gripper for workpieces
- S7-300 PLC controller
- Control panel
- Teach-in positions
- Interface to the conveyor system
- Dimensions: 700 x 900 x 1800 mm



**Networked system operation – communication is key**

Modern production systems are of modular design, with the modules or subsystems featuring powerful communication interfaces. The MPS® 500-FMS uses interfaces such as the I/O coupling, fieldbus and Ethernet similar to those used in typical practical applications.

From the sensor to the web: The optional software packages are an easy way of practicing displaying system data on the Internet.

**The tools of the trade – simulation for robots and systems**

The use of simulation tools for programming systems and analysing system behaviour before or during construction saves time and money. The electrical, mechanical and physical behaviour of the models is the same as that of actual stations and is programmed using the same programming languages (MELFA BASIC and STEP 7). This enables the students to work safely on virtual systems before the tested programs are tried out on the actual system.



**The Vision system**

Camera systems are ideal for use in production and quality assurance thanks to their versatility and reliability. The universally successful industrial system DVT is integrated in the MPS® 500-FMS system:

- Intelligent compact camera
- CMOS (colour on request)
- Resolution 640 x 480 pixels
- Incident light and transmitted light
- Computer link
- Evaluation software for PC



**10 stations – learn the basics in small groups**

MPS® 500-FMS provides up to 10 individual stations for working in small groups of students – providing invaluable benefits for the practical side of training. Each station focuses on something different and offers various levels of complexity. The stations can be gradually brought together once the station-specific training aims have been achieved.

**The process**

The system is a factory comprising six areas linked via a transport system that produces the tried-and-tested short-stroke cylinders from the MPS®.

**Incoming goods**

Cylinder bodies are delivered to the Distributing station and forwarded to the Testing station after inspection.

**Processing**

The Processing station, which simulates a drilling process, represents the machining stage. The Handling station transports the material.

**Quality assurance**

The camera system checks the work-piece.

**Assembly**

An industrial robot in the Robot assembly station performs automated assembly.

**Warehouse**

Parts are stored in the Automatic warehouse station prior to shipping.

**Outgoing goods**

The Handling station transfers products from the conveyor to the Sorting station, where the products are sorted and made available for shipping.

# MPS® 516-FMS

## The complete package for demanding training scenarios



### The system

MPS® 516-FMS system is a complete package comprising hardware and software that can be used straight from the box.

The system comprises 9 stations:

- Incoming goods**  
Distributing and Testing station
- Processing**  
Handling and Processing station
- Assembly**  
Robot assembly station
- Warehouse**  
Automatic warehouse station
- Outgoing goods**  
Handling and Sorting station
- Transport**  
Transport system station

The system can be flexibly expanded using the optional packages.

### The training aims

The multitude of stations and the technologies contained in them permit an investigation of almost all relevant areas of control and automation technology.

- Construction of pneumatic and electropneumatic circuits
- Learning about various sensors and actuators
- Application and programming of PLCs
- Application of various handling devices and grippers
- Application of vacuum technology
- Application of various electrical drives (DC, AC)
- Application of frequency converters
- Construction of a positioning control with incremental shaft encoder
- Networking of sensors and actuators via AS-interface
- Application of industrial robots for assembly tasks
- Programming and simulation of robots
- Set-up and mode of operation of transport systems
- Mode of operation and purpose of pallet identification

MPS 516-FMS

On request

**MPS® 516-FMS range of packages**

Consisting of:

**Stations**

- 1x pallet transport system FMF-F
- 1x automated warehouse
- 1x robot station with Magazine station\*
- 1x Distributing station\*
- 1x Testing station\*
- 2x Handling station\*
- 1x Processing station\*
- 1x Sorting station\*

**Software and media:**

- Programming package STEP 7 Trainer Package
- CIROS®
- Mechatronics Assistant with 12 licences

**Service**

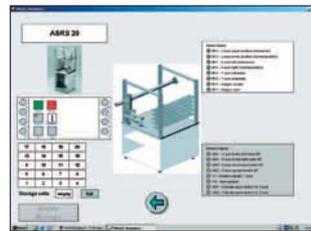
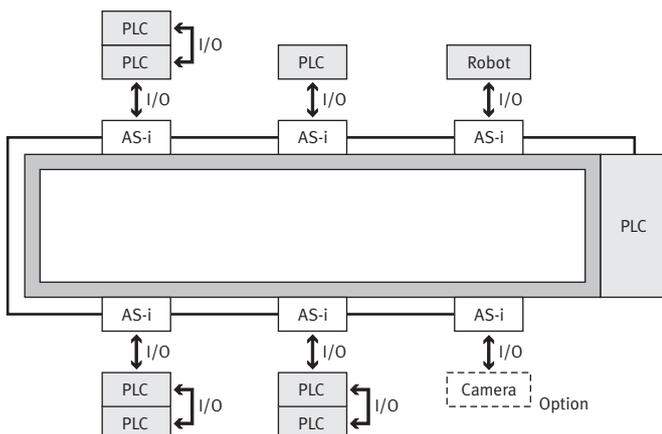
Commissioning and initial training in Germany with delivery, installation and commissioning of the system at the destination. Two days of initial training for up to 4 persons.

\* Includes mobile base frame, MPS® control panel and S7-300 EduTrainer® Universal. Technical data: See MPS® Stations.

**The control concept**

Each station is equipped with its own PLC. The only exception to this is the robot station; in this case the robot controller also controls the magazine and communicates with the transport system via I/Os. Communication between the transport system and the PLCs of the stations also takes place via a straightforward I/O interface. This simple and clear structure is one of the reasons this system is so popular – it facilitates quick and

easy combination of the individual stations into a networked system. The AS-interface fieldbus is used within the transport system. Further additional bus systems can optionally be integrated.



**Optional packages**

**Optional package Vision (V1)**

Industrial CMOS compact camera with integrated illumination and Ethernet interface, mounted on a mobile trolley. The station can be integrated or used on its own for basic training. It is used to determine gripper parameters in connection with the robot assembly station. Professional image processing software is included.

**Optional package Visualisation**

System visualisation and operation on the basis of industrial SCADA software. Communication between SCADA and controllers takes place via fieldbus or Ethernet. Choose from the following options:

- WinCC and Profibus DP for Siemens
- WinCC and Ethernet for Siemens
- InTouch and Ethernet with CPX-CEC
- InTouch and DeviceNet with Allen Bradley

**Optional package CNC**

Upgrade the system with a small PC-controlled CNC machine. The machine is placed beside the assembly robot and looks after automatic loading and unloading. The optional package includes all the software necessary for operation.

- MILL 55
- TURN 60

# MPS® 501-505 FMS

## The entry-level systems



MPS® 501-FMS



MPS® 502-FMS



MPS® 503-FMS



MPS® 504-FMS



MPS® 505-FMS

Even the smaller systems offer a complete sequence with all the essential components of an inter-linked production system.

Why not call us?  
We will be happy to advise you.

# MPS® 512-FMS

Get started right away with a complete and customised package

MPS 512-FMS

On request

## MPS® 512 FMS range of packages

Consisting of:

### Stations

- 1x pallet transport system FMF-F
- 1x Distributing station
- 1x Testing station
- 2x Handling station
- 1x Processing station
- 1x Sorting station

### Software and media

- Programming package STEP 7 Trainer package
- CIROS® Automation Suite
- Mechatronics Assistant with 12 licences

### Service

Commissioning and initial training in Germany



It is becoming more and more common for specialists and engineers to be responsible for operation and maintenance of complex automated production systems. This requires the seamless interaction of all the technologies involved.

MPS® 500-FMS forms the basis for general technological training using practical problems from actual operational applications.

It provides the perfect platform for analysing, understanding and mastering the interaction of mechanics, pneumatics, electrical engineering, control technology and communication interfaces – all absolutely critical for proper and successful management of networked systems.

MPS® 512-FMS is a complete package comprising hardware and software that can be used straight from the box. The system comprises 7 stations:

### Incoming goods

Distributing and Testing station

### Processing

Handling and Processing station

### Outgoing goods

Handling and sorting station

### Transport

Transport system station

The system can be flexibly expanded using the optional packages.

### Special requirements in the area of control technology?

We look forward to talking to you. Our project advisors will be happy to find the ideal solution for you.

# Actuating, networking, operating, monitoring, optimising

## Controlling processes as in industry



### Close to reality

In MPS® – as in real production plants – controllers are responsible for signal processing. The signals in the system can be transferred directly from the station to the controller via I/Os or various fieldbus systems or between controllers to support information exchange.

### Market leading industrial standards

The MPS® is based on industrial standards. Automation solutions and trends from the market leaders are part of the MPS® concept.

- Programmable logic controllers from the market leaders
- Project planning and programming tools complying with IEC61131

The most commonly used fieldbuses: PROFINET, PROFIBUS, AS-Interface, Ethernet

**FESTO**

**SIEMENS**

**MITSUBISHI ELECTRIC**

**Rockwell Automation**

**PROFINET**

**PROFIBUS**

**AS-INTERFACE**

**INDUSTRIAL ETHERNET**

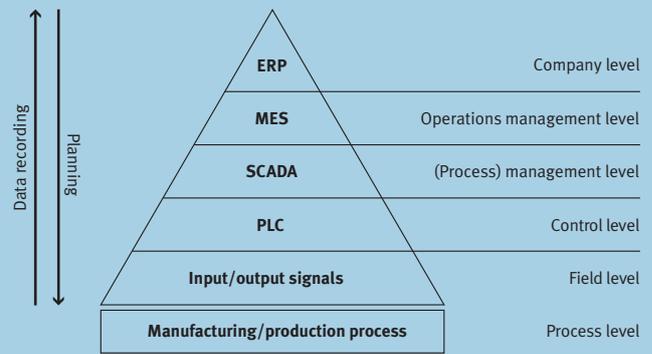


### Choice of PLC – optimised for training use

We can fit an EduTrainer®, providing a completely assembled and wired PLC rack, with the PLC of your choice and, if required, fieldbus components as well. The advantage of the EduTrainer® in the MPS® station is clear: you can remove the controller and use it for other processes or in laboratory furniture.

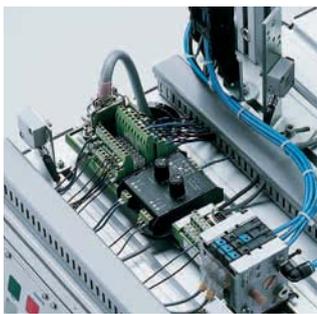
### Reliable safety modules

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



**From field to company level**

All control technologies and systems used in industrial production can be integrated into the modular production system and the learning factories from Festo Didactic. This gives basic and advanced training a high level of practical relevance at all levels of the CIM pyramid.



**Plug and run**

The station, the control console and the EduTrainer® are all equipped with standardised SysLink interfaces. All you have to do is plug them in, there is no need to wire different connectors.



**Hot topic – energy saving**

On the trail of waste: identifying potential savings means first of all measuring current consumption. The Wattmeter acts as a smart meter for training systems with a 24 V DC power supply and a maximum of 120 Watts.

A switchable interface for 0 – 10 V DC or 4 – 20 mA is integrated for data transmission. Ethernet is available as an option.



**Optimising processes – Ensuring quality in production**

Production defects or tolerance deviations identified too late or not at all often lead to expensive consequential damage or recalls.

Optional modules in the MPS® are responsible for continuous quality inspection. Laser sensor and analogue sensors measure the workpiece height. A signal converter can then digitise the analogue signal.

# EduTrainer® Universal Preferred versions MPS®/MPS® PA A4 rack with SIMATIC S7-300



S7-313C (ON, A)	567098
S7-313C-2DP	567103
S7-315F-2PN/DP → see figure	567104
S7-315F-2PN/DP (ON, A)	567099

#### Note

The EduTrainer® Universal as preferred version for MPS® is equipped with a power supply unit; the preferred version for MPS® PA has no power supply unit (ON) but has analogue inputs and outputs (A).

#### Recommended accessories:

I/O data cable with SysLink connectors (IEEE 488) at both ends, 2.5 m	34031
Analogue cable, parallel, 2 m	529141
Safety laboratory cable, 3 m	571817
PC adapter, USB	539006
Programming software STEP 7 → Page 46	
IEC power cable 90° → Page 239	

#### Other accessories:

Digital I/O module SM323 8I/8O	184550
Digital I/O module SM323 16I/16O	529142
Front-panel connector, Screwed contacts, 20-pin	184554
Front-panel connector, Screwed contacts, 40-pin	660560
Analogue I/O module S7-SM334-4E/2A	184804
AS-interface master upgrade S7-300 CP 343-2 AS-i Master	533028
Trainer Package, Internet link S7-300, CP343-1 Advanced	533027
Analogue cable, crossover, 2 m	533039

#### The industrial standard

The modular concept of the SIMATIC S7-300 offers professional PLC technology from the market leader, Siemens. With various CPUs, CPs and I/O modules, the S7-300 meets all automation requirements. This controller facilitates the use of a wide range of fieldbuses such as AS-interface, Profibus DP and Profinet.

The STEP 7 programming environment makes all industrially used PLC programming languages available, such as AWL, KOP, FUP, STEP 7-SCL, STEP 7-GRAPH and STEP 7-HiGraph.

#### EduTrainer® Universal with:

##### CPU 313C

- 64 KB RAM for program and data
- Includes MMC
- Interfaces: MPI
- Inputs/outputs:
  - 24 digital inputs (24 V DC)
  - 16 digital outputs (24 V DC, 400 mA)
  - 4 analogue inputs, 11 bit, 20 ms, ( $\pm 10$  V, 0 – 10 V,  $\pm 20$  mA, 0/4 – 20 mA), 1 Pt100 input
  - 2 analogue outputs, ( $\pm 10$  V, 0 – 10 V,  $\pm 20$  mA, 0/4 – 20 mA)

##### CPU 313C-2DP

- 64 KB RAM for program and data
- Includes MMC
- Interfaces: MPI, Profibus DP
- Inputs/outputs:
  - 16 digital inputs (24 V DC)
  - 16 digital outputs (24 V DC, 400 mA)

##### CPU 315F-2PN/DP

- 256 KB RAM for program and data
- Includes MMC
- Interfaces: MPI, DP, PN
- SM 323:
  - 16 digital inputs (24 V DC)
  - 16 digital outputs (24 V DC, 500 mA)
- SM 334 (only in order no. 567099):
  - 4 analogue inputs, 8 bit (0–10 V, 0 – 20 mA)
  - 2 analogue outputs, (0 – 10 V, 0 – 20 mA)

#### The holder system:

- EduTrainer® A4 rack, desktop variant size 1, W x H 305 mm x 300 mm
- 19" module simulation plate with 2x SysLink plug connector for MPS® station and control panel each with 8 digital inputs and 8 digital outputs and 1 x D-sub 15-pin plug connection with 4 analogue inputs and 2 analogue outputs; emergency stop jumper to connect a safety circuit for disconnecting 8 digital outputs.
- Integrated 110/230 V/24 V, 4.5 A power supply unit (only in order no. 567103 and 567104)
- Can be placed on the desk or in an MPS® station.
- Stable, powder-coated, sheet-steel holder system
- Can be extended with 19" simulation modules → Pages 219 – 220

# EduTrainer® Universal Preferred versions MPS®/MPS® PA

## A4 rack with Festo CPX-CEC

### World language IEC 61131-3

Benefit from automation programming in a world language, based on IEC 61131-3.

For standardised preprocessing: CPX-CEC as an intelligent remote I/O terminal.

### Better performance

CPX-CEC means improved cycle times and more connectable actuators. The modular I/O system with up to 512 I/Os and CAN master functionality 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 CODESYS® embedded controller CPX-CEC:

#### CPX-CEC

- 32 bit MIPS processor, 400 MHz
- Data memory 32 MB flash/ 32 MB RAM
- 20 MB flash/8 MB RAM user memory
- 32 KB non-volatile memory
- Communication network Ethernet 10/100 Base-T
- Integrated web server
- Master CANopen fieldbus
- PLC operating system Codesys® 2.3 Full RTS
- Diagnostic handheld for CPX terminal can be connected
- All FEDs can be connected via Ethernet
- Visualisation OPC server for connection to any SCADA packages

### EduTrainer® Universal digital (MPS®)

- Codesys® V2.3 provided by Festo programming software
- Ethernet cable for programming the CPX-CEC
- 16 digital inputs (24 V DC)
- 16 digital outputs (24 V DC, maximum 500 mA)
- SysLink interfaces
- Power supply: 24 V DC power supply unit integrated

### EduTrainer® Universal analogue (MPS® PA)

- Same as EduTrainer® Universal digital with additional analogue expansion
- Analogue inputs: 4 (12 Bit, 0 – 10 V, 0/4 – 20 mA)
  - Analogue outputs: 2 (12 Bit, 0 – 10 V, 0/4 – 20 mA)
  - Without power supply unit

### The holder system:

- EduTrainer® A4 rack, desktop variant, size 1 (order no. 567274) or size 2 (order no. 567275), W x H 305/458 mm x 300 mm
- 19" module simulation plate with 2x SysLink plug connector for MPS® station and control panel each with 8 digital inputs and 8 digital outputs and 1 x Sub-D 15-pin plug connection with 4 analogue inputs and 2 analogue outputs; emergency stop jumper to connect a safety circuit for disconnecting 8 digital outputs.
- Integrated 110/230 V/24 V, 4.5 A power supply unit (only in order no. 567274)
- The size 1 rack can be placed on a table or in an MPS® station.
- Stable, powder-coated, sheet-steel holder system
- Can be extended with 19" simulation modules → Pages 219 – 220



CPX-CEC digital → see figure	567274
CPX-CEC analogue (ON, A)	567275

#### Notes

The EduTrainer® Universal as preferred version for MPS® is equipped with a power supply unit; the preferred version for MPS® PA has no power supply unit (ON) but has analogue inputs and outputs (A).

Includes Ethernet cable for programming the CPX-CEC and Codesys® V2.3 programming software provided by Festo (→ Page 47).

#### Recommended accessories:

I/O data cable with SysLink connectors (IEEE 488) at both ends, 2.5 m	34031
Analogue cable, parallel, 2 m	529141
Safety laboratory cable, 3 m	571817
IEC power cable 90° → Page 239	

#### Other accessories:

Analogue terminal	526213
Analogue cable, crossover, 2 m	533039

# EduTrainer® Universal Preferred versions MPS®/MPS® PA A4 rack with Allen Bradley ML 1500



ML 1500 digital → see figure	567107
ML 1500 analogue (ON, A)	567102

**Note**

The EduTrainer® Universal as preferred version for MPS® is equipped with a power supply unit; the preferred version for MPS® PA has no power supply unit (ON) but has analogue inputs and outputs (A).

**Recommended accessories:**

I/O data cable with SysLink connectors (IEEE 488) at both ends, 2.5 m	34031
Analogue cable, parallel, 2 m	529141
Safety laboratory cable, 3 m	571817
Programming cable ML 1500	535827
RSLogix 500 Starter, en	535829
IEC power cable 90° → Page 239	

**Other accessories:**

Digital extension ML 1500	535822
Analogue extension ML 1500	541126
Ethernet extension ML 1500	541127
Analogue cable, crossover, 2 m	533039

**The standard in North America**

The Micro Logix modular concept from Allen Bradley offers professional PLC technology. With various CPUs and modules, the ML series meets all automation requirements.

The ML 1500 facilitates the use of a wide range of fieldbuses such as DeviceNet and Ethernet. The RSLogix 500 programming software makes the PLC programming language LD available.

**EduTrainer® Universal with Allen-Bradley ML 1500:**

**ML 1500 + compact IN/OUT module**

- Program memory: 7K + 8k
- Interfaces: RS-232-C
- Programmable PID controller I/Os:
- 22 digital inputs (24 V DC), of which 8 high speed counter via config
- 16 digital outputs (24 V DC, 1 A), of which 2 high speed outputs via config, 2 integrated analogue potentiometers

**EduTrainer® Universal digital (MPS®)**

- Power supply: 24 V DC power supply unit integrated
- SysLink interfaces:
  - 1 x cable for connection to station
  - 1 x cable for connection to console
  - 1 x bridge for connection to emergency stop

**EduTrainer® Universal analogue (MPS® PA)**

- Same as EduTrainer® Universal digital with additional analogue expansion
- Without power supply unit

**CPU modules:**

**Digital extension ML 1500**

- Digital I/O module
- 1769-IQ6X0W4-4I/O (6 IN/4 OUT)

**Analogue extension ML 1500**

- Analogue I/O module
- 1769-IF4XOF2 (4 IN/2 OUT)

**Ethernet extension ML 1500**

- ENI Ethernet interface
- 1761-NET-ENI

**The holder system:**

- EduTrainer® A4 rack, desktop variant size 1, W x H 305 mm x 300 mm
- 19" module simulation plate with 2x SysLink plug connector for MPS® station and control panel, each with 8 digital inputs and 8 digital outputs and 1 x Sub-D 15-pin plug connection with 4 analogue inputs and 2 analogue outputs; emergency stop jumper to connect a safety circuit for disconnecting 8 digital outputs.
- Integrated 110/230 V/24 V, 4.5 A power supply unit (only with order no. 567107)
- Can be placed on a desk or in an MPS® station
- Stable, powder-coated, sheet-steel holder system
- Can be extended with 19" simulation modules → Pages 219 – 220

# EduTrainer® Universal Preferred versions MPS®/MPS® PA A4 rack with Mitsubishi MELSEC FX1N

## High functionality

The modular concept of the MELSEC FX1N from Mitsubishi offers professional PLC technology from a high-tech company.

The FX1N with its various upgrades provides all the functions required of a mini control system for automation technology. The FX1N facilitates the use of a wide range of fieldbuses such as AS-interface, Profibus DP and Ethernet. The MELSOFT GX IEC Developer programming environment makes industry-related and IEC 61131-3-compliant PLC programming languages such as IL, LD, FBD, SFC and ST available.

**EduTrainer® Universal with MELSEC FX1N-40MT-DSS**  
PLC with integrated I/Os:

### FX1N

- 8 k program memory
- Interfaces: RS 232
- I/Os:
- 24 digital inputs (24 V DC)
- 16 digital outputs (24 V DC, 500 mA)

### EduTrainer® Universal digital (MPS®)

- Power supply: Integrated 24 V DC power supply unit
- SysLink interfaces:
- 1 x cable for connection to station
- 1 x cable for connection to console
- 1 x bridge for connection to emergency stop

### EduTrainer® Universal analogue (MPS® PA)

- Same as EduTrainer® Universal digital with additional analogue expansion
- Without power supply unit

## CPU modules:

### Analogue extension FX1N

- Analogue I/O module FX0N-3A (2 IN/1 OUT)

### AS-interface extension FX1N

- AS-i master FX2N-32ASI-M

### Ethernet extension FX1N

- Ethernet FX2NC-ENET-ADP + FX1NCNV-BD

## The holder system:

- EduTrainer® A4 rack, desktop variant size 1, W x H 305 mm x 300 mm
- 19" module simulation plate with 2x SysLink plug connector for MPS® station and control panel, each with 8 digital inputs and 8 digital outputs and 1 x Sub-D 15-pin plug connection with 4 analogue inputs and 2 analogue outputs; emergency stop jumper to connect a safety circuit for disconnecting 8 digital outputs.
- Integrated 110/230 V/24 V, 4.5 A power supply unit (only with order no. 567106)
- Can be placed on a desk or in an MPS® station
- Stable, powder-coated, sheet-steel holder system
- Can be extended with 19" simulation modules → Pages 219 – 220



MELSEC FX1N analogue (ON, A) → see figure	567101
MELSEC FX1N digital	567106

### Note

The EduTrainer® Universal as preferred version for MPS® is equipped with a power supply unit; the preferred version for MPS® PA has no power supply unit (ON) but has analogue inputs and outputs (A).

### Recommended accessories:

I/O data cable with SysLink connectors (IEEE 488) at both ends, 2.5 m	34031
Analogue cable, parallel, 2 m	529141
Safety laboratory cable, 3 m	571817
Programming cable FX1N	540683
Mitsubishi GX Trainer Package, de/en	541149
IEC power cable 90° → Page 239	

### Other accessories:

Analogue extension FX1N	541128
AS-interface extension FX1N	541129
Ethernet extension FX1N	541131

# Safety engineering



## MPS® module safety engineering holder system

This mounting kit for MPS safety engineering can be used to optimally mount the MPS® modules door, door with active bolt, light curtain and the MPS® control console to any MPS® station.

- Horizontal angle
- 19" front cover and short cable duct
- Assembly instructions

Order no. **549849**

## Recommended training media, also order:

Training documentation  
"The safe system" → Page 73



Safety engineering: WBT → Page 26



## MPS® module light curtain

Contactless light curtains protect operating personnel against undesired or unintentional entry into the danger areas of technical systems, such as presses, robot inserting stations, transfer lines and palletising systems.

The MPS® module light curtain is used to extend any MPS® station in the area of safety engineering and is mounted on the MPS® module safety engineering holder system. The module consists of a transmitter and a receiver, mounted opposite one another. The infrared LEDs on the transmitter emit brief light pulses that are received by the receiver diodes.

- Light curtain with transmitter and receiver
- Connecting cable (5 m)

## Technical data

- Size of transmitter/receiver module (W x H x D): 300 x 34 x 29 mm
- Supply voltage: 24 V DC
- Maximum switching current: 500 mA
- Wavelength: 950 nm
- Protection field height: 300 mm
- Resolution: 20 mm
- Reach: up to 6 m

Order no. **549850**

Suitable here:

- MPS® module safety engineering holder system  
Order no. **549849**
- Safety relay from Pilz  
Order no. **573283**
- 19" emergency stop module (9 HP)  
Order no. **573860**



## MPS® module door

According to directive DIN EN ISO 12100, Machine Safety, all movable parts on machines must be secured with protective devices. The MPS® safety engineering product range is ideal as part of training on this subject.

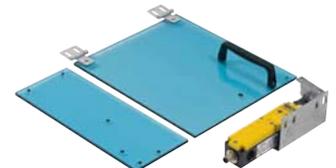
The door includes a safety switch and can be mounted on any MPS® station using the MPS® module safety engineering holder system.

- As soon as the protective device is opened, the N/C contacts on the safety switch open. The hazardous machine motion is then stopped.
- 2 doors (1x 117 mm high, 1x 260 mm high)
- 1 safety switch with 2 N/C contacts without active locking mechanism
- 1 connecting cable (5 m)

Order no. **549851**

Suitable here:

- MPS® module safety engineering holder system  
Order no. **549849**
- Safety relay from Sick  
Order no. **573282**
- 19" emergency stop module (9 HP)  
Order no. **573860**



## MPS® module door with active locking mechanism

According to directive DIN EN ISO 12100, Machine Safety, all movable parts on machines must be secured with protective devices. The MPS® safety engineering product range is ideal as part of training on this subject.

The door includes a safety switch and can be mounted on any MPS® station using the MPS® module safety engineering holder system.

- As soon as the protective device is opened, the N/C contacts on the safety switch open. The hazardous machine motion is then stopped.
- 2 doors (1x 117 mm high, 1x 260 mm high)
- 1 safety switch with N/C contact, N/O contact and active locking mechanism (1200 N locking force)
- 1 connecting cable (5 m)

Order no. **549852**

Suitable here:

- MPS® module safety engineering holder system  
Order no. **549849**
- Safety relay from Sick  
Order no. **573282**
- 19" emergency stop module (9 HP)  
Order no. **573860**
- 19" request module (3 HP)  
Order no. **573861**



### 19" emergency stop module (9 HP)

The 19" emergency stop module (9 modular spacing units) makes it possible to expand the MPS® control panel to include an emergency-stop mushroom actuator and a key-operated reset pushbutton. The module can be connected to a safety relay, an emergency stop PCB or a failsafe PLC with a 2.5 metre long connecting cable. 4 mm plugs are required for direct connection to the emergency stop jumper of an EduTrainer® Universal.

Blank panels are not included in the scope of delivery.

Order no. **573860**

### 19" request module (3 HP)

The 19" request module (3 modular spacing units) makes it possible to expand the MPS® control panel to include a key-operated request pushbutton and a reset pushbutton. The module can be connected to a safety relay with a 2.5 metre long connecting cable.

Blank panels are not included in the scope of delivery.

Order no. **573861**



### Safety relay from Pilz

The safety switching device fulfils the requirements of EN 60947-5-1, EN 60204-1 and VDE 0113-1, and can be used in applications with:

- Emergency stop pushbuttons
- Safety switches
- Light barriers

Forced relay outputs:

- 3 safety contacts (S), undelayed
- 1 auxiliary contact (Ö), undelayed
- 1 semiconductor output
- 1 contact expansion block, connectable, operating modes can be adjusted via rotary switch.

LED display for:

- Supply voltage
- Input status channel 1
- Input status channel 2
- Switching status of safety contacts
- Starting circuit
- Error

Plug-in terminals. Connection material included.

Order no. **573283**

### Safety relay from Sick

The safety switching device can be used in applications with:

- Emergency stop switches
- Safety switches
- Safety switches with mechanical locking

Cross circuit recognition for dual-channel control. Outputs: 2 N/O contacts, 1 response delayed N/O contact, adjustable from 0.15 – 3 s or 1.5 – 30 s.

- 3 LEDs: supply voltage, C1/C2 relay (undelayed) and C3/C4 relay (delayed)
- Manual reset
- Automatic reset
- Contact expansion for more outputs

Connection material included.

Order no. **573282**



### 19" emergency stop panel

The emergency stop panel allows integration of the emergency stop pushbutton into the control panel. The pushbutton is connected to a EduTrainer® or an emergency stop board via a 2.5 m cable with 2-pin screw-terminal plug.

The emergency off panel can be integrated into the control panel order no. 195764. A blank panel order no. 534630 is required for installation into the control panel. The blank panel is not included.

Order no. **534631**

### 19" blank panel (16 HP) for the control panel

Order no. **534630**

### Light tower module

The LED light tower with 3 signal lights (red, yellow, green) shows different statuses of a system and is suitable for all MPS® stations. With protection class IP 65. It is secured to the slotted assembly board with the materials supplied.

Delivery includes a base and a 2 meter connecting cable with open ends for connecting to the I/O terminal of the MPS® station.

Order no. **549843**



### Emergency stop board

The flexible safety concept for the MPS® provides an easy method of switching off components – whether the entire system or parts thereof. The central emergency stop board is part of the safety concept in the Modular Production System and allows you to integrate up to ten MPS® stations into a safety circuit. When combined with emergency stop pushbuttons and/or position switches, it provides a high level of safety. The central emergency stop board can be mounted in the trolley of a station along with a EduTrainer® Universal.

A 4-pin cable (order no. 535245) is required for each station for connection. This cable is not included in the scope of delivery. The connected stations can be switched off via max. 6 emergency stop switches. These emergency stop switches are not included in the scope of delivery.

- Inputs (emergency stop switch)

1 – 6

- Outputs (stations) 1 – 10

Order no. **195769**

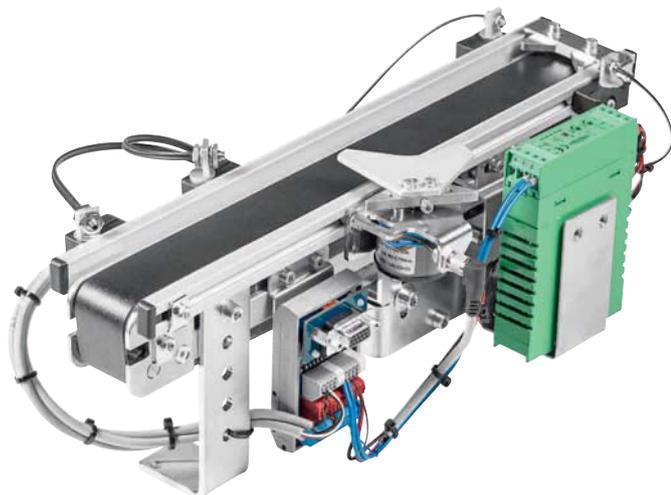
### Also order:

Connecting cable, 4-pin, for connecting an MPS® station (EduTrainer® Universal) to the emergency stop board.

Order no. **535245**

# Conveyor module

New



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. "Cylinder bodies" or "Cylinder for assembly" workpiece sets). The module is supplied completely assembled.

### Training content

- Belt control
- Sensor technology
- 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
  - Through-beam sensor
  - Mini I/O terminal
  - Mounting accessories for profile plate
  - Feed separator/stopper, electric

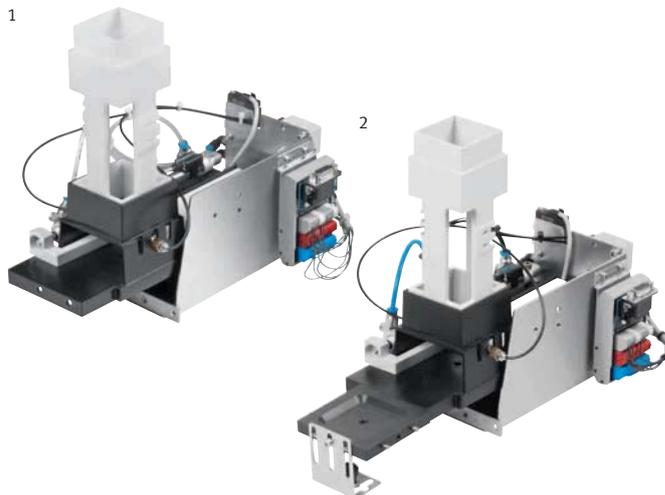


300 x 40 mm, DC	8033135
350 x 40 mm, DC → see figure	8032692
350 x 40 mm, without motor	On request
700 x 40 mm, without motor	On request

Recommended accessories:	
MPS slotted mounting plate	8038504
PA workpiece set	554301
15-pin Sub-D HD cables: connector – connector, 2.0 m	8033584
15-pin Sub-D HD cables: connector – open, 2.0 m	8033586
C interface	8025738

# Stacking magazine module

New



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 inductive 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-moulded 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 module	8032173
MPS slotted mounting plate	8038504
PA workpiece set	554301
15-pin Sub-D HD cables: connector – connector, 2.0 m	8033584
15-pin Sub-D HD cables: connector – open, 2.0 m	8033586
C interface	8025738

## Pick&Place module

New



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 limiter 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

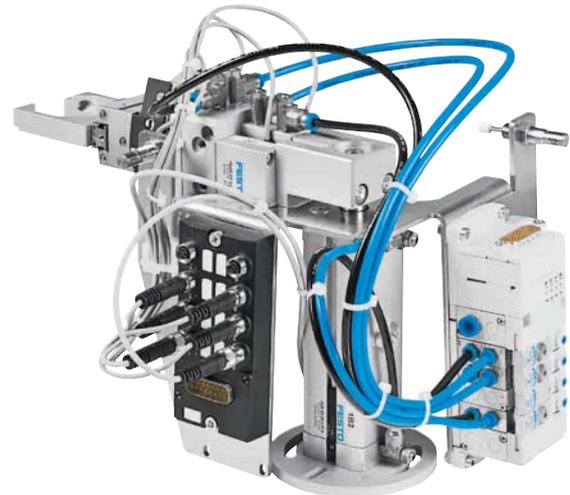
### Technical data

- 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
- P&P unit, height-adjustable
- Pressure limitation along the Z-axis

### Scope of delivery

- Mini I/O terminal
- Valve terminal with 2 x 5/2-way single solenoid valves and 1 x 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)

## Turning module



The turning module is used whenever a workpiece is to be tipped, turned or emptied.

Limit switches are used to sense all movements. End-position cushioning ensures that the end position is approached gently. The module is equipped with a multi-pin connector for the sensors and a valve terminal CPV-SC.

### Training content

- Basic principles of pneumatics
- Sensor technology: magnetic limit switches
- Connecting tubing and wiring
- Reading circuit diagrams
- Getting to know handling systems
- Gripper technology/stroke/swivelling/gripping

### Technical data

- 6 x sensor, digital (PNP)
- 4 x output for 3 actuators
- 1 x supply port (6 bar)

### Scope of delivery

- Multi-pin plug (8 channels)
- Valve terminal with 2 x 5/2-way single solenoid valves and 1 x 5/2-way double pilot valve
- 2 double-acting cylinders with guide slot for swivel motion
- Shock absorber
- 6 magnetic limit switches
- Mounting accessories for profile plate
- Gripper jaws

With vacuum technology → see figure	8031659
With parallel gripper	8031660

### Recommended accessories:

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

Order no. **549855**

# Accessories

New



### MPS® trolley, 700 x 350

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 centre 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 DIN 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

Without height adjustment

Order no. **8033248**

With height adjustment

Order no. **8033590**



### 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. The MPS® trolley 700 x 350 (order no. 8033248) can be retrofitted with this height adjustment.

### Technical data

- Minimum load: 7 kg
- Height in retracted state: 665 mm
- Lift height: 400 mm

### Scope of delivery

- Column with adapter plates and Bowden cable
- Mounting accessories for trolley and profile plate

Order no. **8033591**



### 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

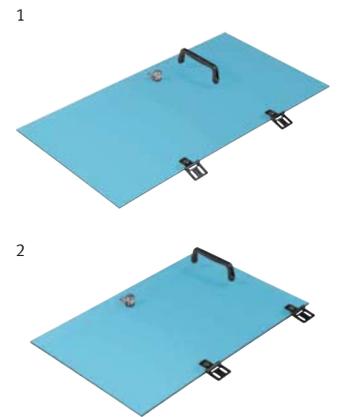
- Holder for profiles
- 2 x A4 mounting profiles
- Mounting accessories for profile and profile plate

Order no. **8033592**

### 2 MPS® A4 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® door

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

### Technical data

- Dimensions when fully closed (H x W): 645 x 334 mm
- Dimensions for trolley with control panel (H x W): 500 x 334 mm
- Can be hinged on right or left

### Scope of delivery

- Plexiglass door
- 2 hinges
- Handle
- Lock with key
- Mounting accessories

1 645 x 334 mm **8033596**

2 500 x 334 mm **8033595**



**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.

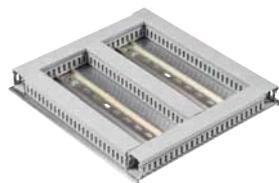
**Technical data**

Interior dimensions per drawer (H x W x D): 120 x 274 x 300 mm

**Scope of delivery**

- 2 drawers
- 4 ball bearings
- Intermediate shelf
- Mounting accessories

Order no. **8033593**



**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 this 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**



**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

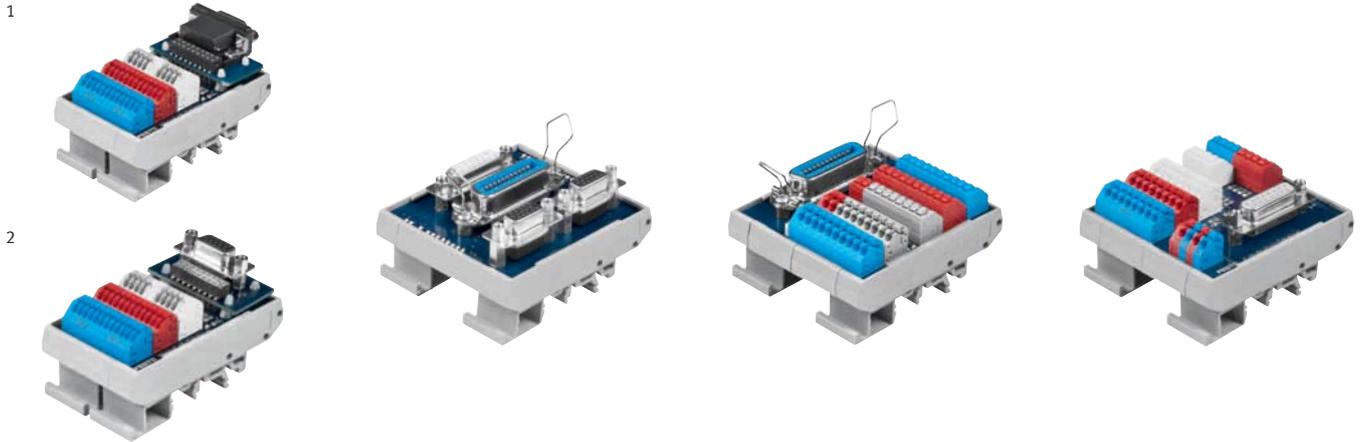
**Scope of delivery**

- 10 cable holders
- 10 M4 x 15 screws
- 10 T-head nuts for profile plate slot

Order no. **8034300**

# Accessories

New



## 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 analogue inputs and one analogue 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
- Inputs: 4
- Digital outputs: 4
- Analogue inputs: 2
- Analogue output: 1
- Spring-loaded terminal: 0.2 – 0.5 mm<sup>2</sup>
- 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 analogue 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
- 2 x 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
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## 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 mm<sup>2</sup>
- 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
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## Analogue I/O terminal

Analogue signals are routed to a special analogue terminal with a 15-pin Sub-D socket. It is used to wire four analogue inputs and 2 analogue 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 mm<sup>2</sup>
- 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
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#### 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.

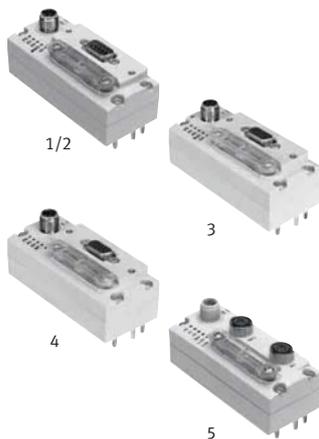
#### Technical data

- M12 I-Port IO-Link interface with 24 V/0 V
- 2 x 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**



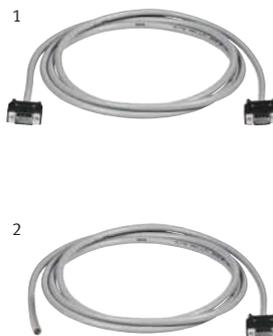
#### Fieldbus node CTEU

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*	<b>8039079</b>
2 DeviceNet*	<b>8039078</b>
3 CC-Link	<b>1544198</b>
4 PROFIBUS DP	<b>570040</b>
5 EtherCAT	<b>572556</b>

\* Including connecting cable



#### 1 15-pin Sub-D HD cables:

##### 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 analogue inputs and one analogue output in parallel.

#### Technical data

- Wires: 16 x 0.25 mm<sup>2</sup>
- 15-pin Sub-D HD plug connector

0.5 m	<b>8033582</b>
1.0 m	<b>8033583</b>
2.0 m	<b>8033584</b>

#### 2 15-pin Sub-D HD cables:

##### Connector – open

For the connection of MPS® modules to the digital or analogue 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 analogue inputs and one analogue output.

#### Technical data

- Wires: 16 x 0.25 mm<sup>2</sup>
- 15-pin Sub-D HD plug connector

2.0 m	<b>8033586</b>
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#### 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**

# Accessories



### Workpiece insert “Thermometer”

Thermometer insert for mounting in housing.

- External diameter: 40 mm
- Mounting diameter: 30 mm

Order no. **534622**



### Workpiece insert “Hygrometer”

Hygrometer insert for mounting in housing.

- External diameter: 40 mm
- Mounting diameter: 30 mm

Order no. **534623**

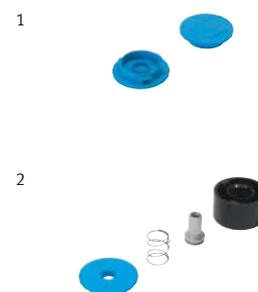


### Workpiece insert “Clock”

Quartz clock insert for mounting in housing.

- External diameter: 40 mm
- Mounting diameter: 30 mm

Order no. **534621**



### 1 Workpiece set “Cylinder end caps”

Parts 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. The hydraulic press station can, however, also be operated with end caps that already have a hole.

Number of end caps: 50

Order no. **162240**

### 2 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 aluminium cylinders.

- External diameter: 40 mm
- Height (black): 22.5 mm
- Height (red and aluminium): 25 mm

Order no. **162239**



**1 Workpiece set “Cylinder bodies”**  
 The workpiece set comprises 4 black and 4 red plastic cylinder bodies and 4 aluminium cylinder bodies.  
 – External diameter: 40 mm  
 – Height (black): 22.5 mm  
 – Height (red and aluminium): 25 mm  
 Order no. **167021**

**2 Workpiece set “Reject bodies”**  
 The workpiece set comprises 2 black and 2 red plastic cylinder bodies and 2 aluminium cylinder bodies.  
 – External diameter: 40 mm  
 – Height: Each colour: 1x 23 mm and 1x 24 mm  
 Order no. **534368**



**1 Workpiece set “Housings”**  
 The workpiece set comprises 4 black and 4 red plastic housings and 4 aluminium housings. The “Clock”, “Thermometer” and “Hygrometer” inserts can be mounted in the bodies.  
 – External diameter: 40 mm  
 – Internal diameter: 30 mm  
 – Height: 23 mm  
 Order no. **534619**

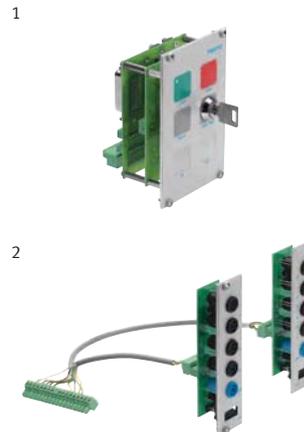
**2 Workpiece set “Reject housings”**  
 The workpiece set comprises 3 black and 3 red plastic housings and 3 aluminium housings.  
 – External diameter: 40 mm  
 Black workpieces:  
 – Internal diameter: 30 mm  
 – Heights: 22/24/25 mm  
 Red workpieces:  
 – Internal diameter: 30 mm  
 – Heights: 26/27/28 mm  
 Aluminium workpieces:  
 – Internal diameter: 30.2/30.4/30.6 mm  
 – Height: 23 mm  
 Order no. **534620**



**PA workpiece set**  
 To fill liquids into the MPS® PA Bottling station. The workpieces are compatible with the MPS® stations. For example, the pot in the Pick&Place station can be sealed with the lid.

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**

# Accessories



## Operating and observing

Knowing what's going on – and responding accordingly. That's the simple idea on which the technology for the automation of whole production processes has been based.

Operating and observing means mastering the process. It means keeping machines and systems running at their optimal levels. And it means high availability and productivity.

## Visualisation in the Net

Visualise and operate your MPS® stations and systems using the latest visualisation software from the market leaders. Learn the application of visualisation software, connection to the production process, the creation of your own process images – and even connection to the Internet.

## Expandable

If additional control or display elements are required for customised design of the information flow, ready-to-use terminal strips on the rear of the control console allow quick and easy expansion.

## MPS® control console for SysLink

The MPS® control console allows simpler operation of the MPS® station. SysLink or AS-interface – various interfaces ensure versatility of use. Fully assembled with operating panel, communication panels, spare panel and mounting frame with SysLink connector.

Membrane keyboard: Start pushbutton with LED, Stop pushbutton, Reset pushbutton with LED, 2 flexibly assignable control lamps (see also Order no. 195766). 4 mm safety sockets with LED status display for simple I/O connection (see also Order no. 195767). Syslink and Sub-D sockets for connection to PLC of choice are available on the rear panel.

## MPS® control console for AS-interface

Fully assembled with AS-interface control console, communication panels, spare panel and mounting frame with AS-interface connector.

SysLink	195764
AS-Interface	535814
SysLink, 700 mm	8039325

## 1 19" control panel

The control panel is connected to a controller via SysLink. The control panel allows up to 16 operating inputs and 16 operating outputs to be connected. The signals from pushbuttons, switches, signal lamps, free inputs and free outputs are available at additional terminals.

- Pushbutton (switch):
- Start (normally open)
  - Stop (normally closed)
  - Reset (normally open)
  - Auto/Man (normally open)

- LED displays:
- Start LED
  - Reset LED
  - Indicator lamp Q1
  - Indicator lamp Q2

Order no. **195766**

## 2 19" communication panels

If the control console is used for several combined stations, communication panels allow simple and transparent exchange of additional signals and information between the stations. 4 inputs and 4 outputs are available at 4 mm safety sockets.

Order no. **195767**

## 1 19" mounting frame

19" frame for mounting of control panels. The frame can be mounted on the MPS® trolley.  
– Width: 310 mm  
– Height: 132 mm

Order no. **526206**

## 2 19" spare panel (32 HP)

For the integration of additional control components.

Order no. **195765**

Touch panels  
→ Pages 226 – 227



**1 Aluminium profile plate 350 x 700**

The anodised aluminium profile plates are used for mounting all components of the MPS® stations. Both sides are slotted, so if necessary parts can be mounted on both sides. The slots are compatible with the ITEM profile system. The board is supplied with caps for the sides. Fits on MPS® trolley, 700 x 350.

- Height: 32 mm
- Grid spacing (from slot to slot): 50 mm
- Width: 350 mm
- Length: 700 mm

Order no. **162386**

The profile plate 350/700 has a hole with a diameter of approx. 5 cm for the I/O cable that connects the Edu-Trainer® Universal to the station (not shown).

Order no. **170395**

**2 Rubber feet**

For non-slip, protective mounting of profile plates on tabletops of any type. Set (4 pieces).

- Natural rubber, colour does not rub off upon contact
- Abrasion resistant quality
- Colour: grey, similar to RAL 7001
- Rubber foot with M6x8 plus M6 nut
- Set consists of 4 pieces

Order no. **158343**



**1 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. **162416**

With IEC power cable, 1.3 m, with: 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**

**2 Profile plate connector**

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

- Length: 45 mm
- Mounting method: Bolt with rotating head and M6 hammer-head nut

Order no. **162228**



**Robot interface box**

Supplement to Robot station

The Robot interface box allows the robot controller to undertake additional PLC functions.

Up to 16 robot controller I/Os can be distributed to 4 SysLink sockets with the Robot interface box. The Robot interface box is connected to the robot controller's I/O card via a 50-pin Centronics connector. On the front panel are LEDs to display the status of the robot I/Os. On the rear panel are 4 SysLink sockets for connection to peripherals.

Order no. **534364**

**Tool set**

The tool set is an aid to easy working on stations. A practical mini-systainer includes:

- 200 mm steel rule
- Open-jawed spanners size 7, 8, 9, 10
- Adjustable spanner
- Side cutter
- Insulation-stripping pliers
- Wire end sleeve pliers
- Screwdriver set, hex, 1.5 – 6
- Screwdriver, hex, 0.9; 1.3
- Screwdriver, cross-head, PZ02 – short
- Screwdriver, flat, 2.5 x 75; 4.0 x 100
- Screwdriver, flat, 1.2 – 1.6
- Tubing cutter
- Fibre-optic cable cutter
- Workpiece, red, black, silver
- 100 x cable binders 2.5 x 100
- 100 x wire end sleeves 0.25
- 100 x wire end sleeves 0.75

Order no. **539767**

# ProLog Factory

## Logistics – Communication – Mechatronics – Robotics



### The new training platform for logistics, communication technology, mechatronics, robotics and industrial engineering

The processes and material flow in the ProLog learning factory are a representation of a real production system with logistics and shipping.

It includes intermediate buffers and magazines for the raw materials and an automatic store for the individual products. The production line produces the parts with low stock levels according to the KANBAN principle.



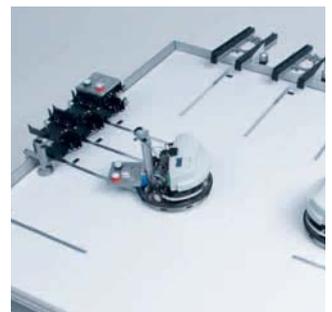
#### Production line

The production line produces the products. Individual stations provide the raw materials. The system tests, processes and assembles the unfinished parts into products. The high bay warehouse stores the finished parts until they are reused.



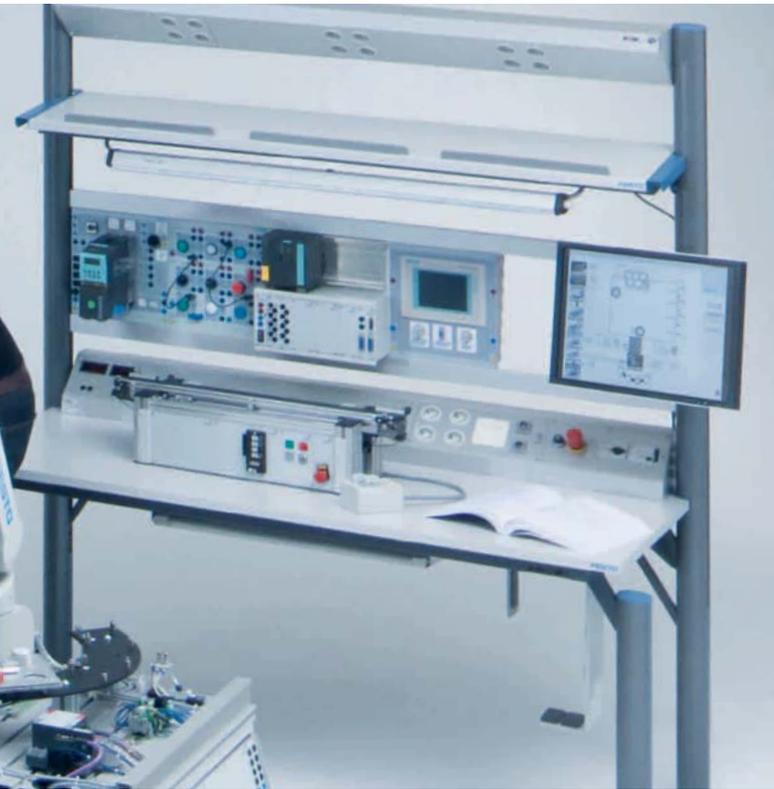
#### Picking station

The orders are compiled in the picking station. An industrial articulated robot arm places the orders onto pallets.



#### Logistics field

The logistics field provides the buffer function on pallets until delivery of the orders.



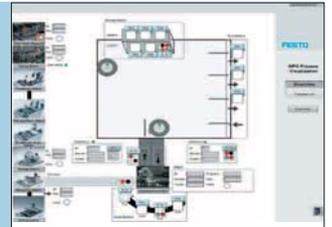
**HMI and communication technology**

A wide range of different networking and communication principles are used in the ProLog Factory.

The SCADA application includes:

- Visualisation of the status of the entire system and the individual stations
- Communication with the stations via Ethernet/Profibus DP
- Alarm messaging
- Alarm logging
- System control
- Data acquisition
- Order entry
- Database application
- Order management

Profibus DP and WLAN communication are also clearly integrated into the learning factory.



**Mobile autonomous robots**

Mobile robots play an increasingly important role in automated production. Within the ProLog learning factory, realistic experiments and practical, relevant training on these new trends are possible.

The mobile robots are equipped with a telescopic fork and operate like forklift trucks to reach all positions in the warehouse.



**Robotics**

The complete cell contains an application with handling and palletising tasks. The robot is equipped with a pneumatic gripper. Different automated modules are arranged in the cell to create a typical robot training environment.

The cell can be equipped with a choice of different 6 axis robots.



**Mechatronics**

The MPS® stations in the ProLog learning factory include:

- Everything for PLC training
- A wide selection of different handling components
- Vacuum technology
- Sensor technology
- Drive technology



**Motivated research and learning**

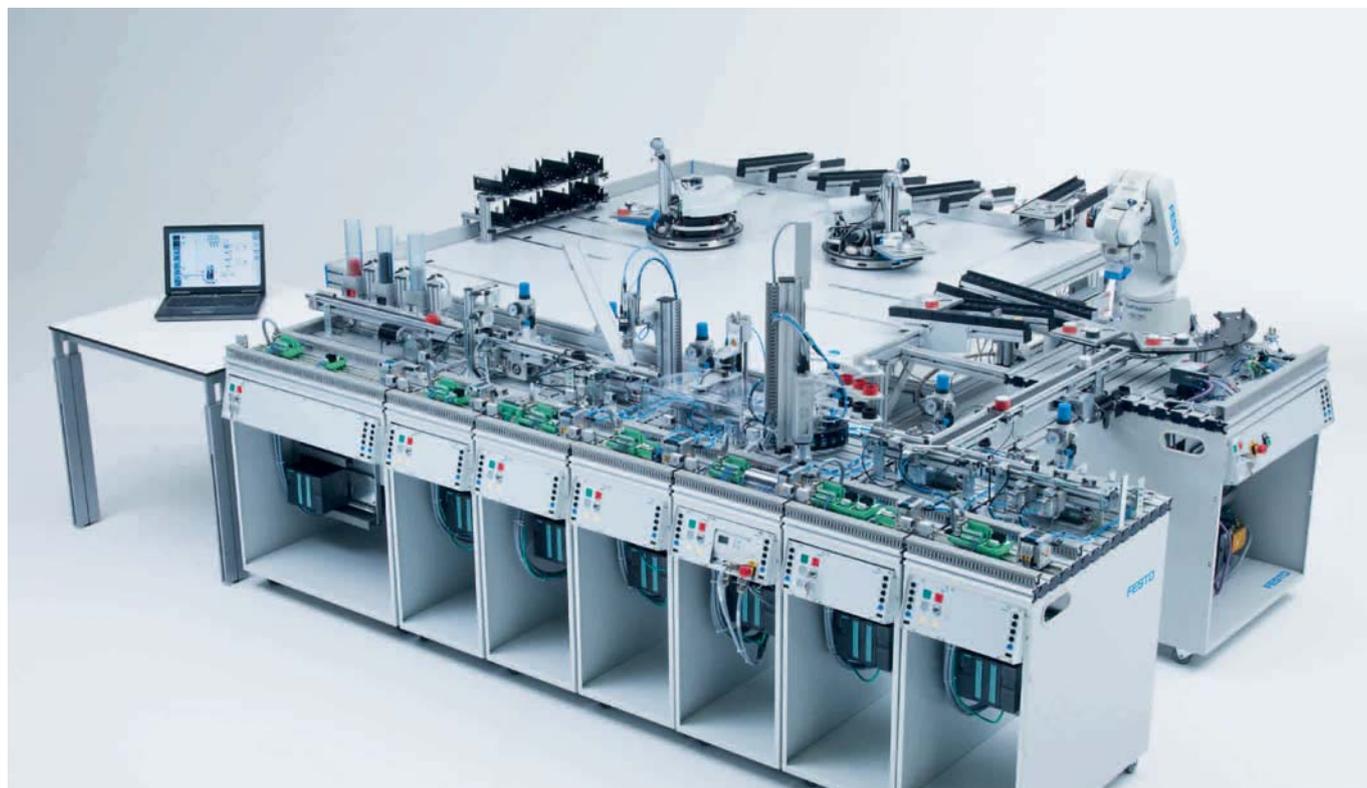
Using the ProLog Factory provides practical training on necessary soft skills as well as the technical expertise:

- Teamwork
- Cooperation
- Learning skills
- Independence
- Organisational ability

The Robotino® View, Robotino® SIM and CIROS® programming and simulation tools increase learning success and efficiency in the learning factory.

# Technologies and processes

## Top issues in the ProLog Factory



### Drive technology and closed-loop control

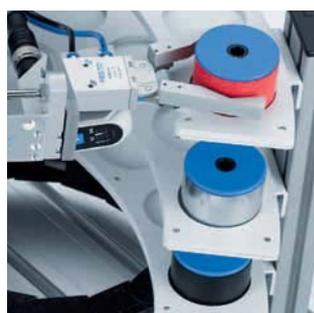
The ProLog Factory features a variety of modern drive technology. High-end drives from Festo, such as the servo motor MTR-DCI, the mini slide with integrated encoder, a range of pneumatic linear axes and DC motors for the belts, provide a wealth of training material.

The Robotino® is perfect for providing training in closed-loop control. As a driverless transport system in the ProLog Factory, it is driven by a combination of three controlled industrial motors with shaft encoder.



### Handling and vacuum technology

At numerous points in the system, workpieces have to be gripped, transported and positioned, often using vacuum technology. As in any modern system with handling technology, the ProLog Factory contains suction grippers, vacuum generators and sensors, valve terminals and proportional pressure regulators on the one hand, and pneumatic muscles, linear slides and rotary drives on the other.



### Sensor technology and navigation

In the ProLog Factory, numerous sensors ensure safety, precision and quality in automation technology. Optical, inductive and capacitive sensors, colour, laser and pressure sensors make the system into a complex learning system for potential sensor specialists.

The Robotino® is an autonomous industrial truck and always needs to know where it is. With its distance sensors, the colour camera and the gyroscope sensor, it enables the topic of navigation to be included in the training.



### RFID technology

Totally unknown a few years ago, but now an issue for more than just automation technology, the RFID chip is the modern rating plate for consumer goods and packaging and has become established as part of our daily lives.

The ProLog Factory uses RFID technology to save order data and production statuses on the pallet, thus providing an up-to-the-minute topic for training in automation technology.

ProLog Factory

On request

**Package range**

Consisting of:

**Production line**

MPS® stations distributing 3-way magazine\*, testing\*, pick &amp; place\*, fluidic muscle press\*, storage\*, separation\* and sorting\*

**Picking station**

With industrial robot

**Logistics area**

With high bay warehouse and 2 mobile robots

**SCADA computer**

With visualisation application

**Software and media**

Programming package STEP 7 Trainer Package, CIROS®, Mechatronics Assistant, WinCC, Robotino® View, Robotino® SIM

\* Includes mobile frame, MPS® control panel and EduTrainer® Universal S7-300.

**The production process**

The material and information flow in the ProLog Factory reflects the processes in modern production, including logistics and shipping. Raw material is stored in buffers and magazines, while end products are transported to an automated goods-out warehouse.

Production is based on the KANBAN principle. Free stock locations are restocked with unfinished parts immediately. Colour and laser sensors ensure that parts with quality defects are sorted out.

The workpieces are assembled by the fluidic muscle press and pick & place MPS® stations. In the storage station, the finished parts wait to be fed to the picking robot “just in sequence” and palletised for specific orders.

After picking, the Robotino® takes on the pallets. It takes them to the goods-out area or to interim storage. If it has time, it takes empty pallets back to the picking station.

**System management**

The ProLog Factory is supplied complete with visualisation. The master computer can be used to monitor all signals, functions and processes. Customer-specific orders are also entered here – a great feature for interdisciplinary co-operation, e.g. with trainees in commercial disciplines.


**Energy monitoring with DC Wattmeter**

Anyone who wants to discover potential savings can begin by measuring the current consumption. The data recorded by the DC Wattmeter goes to the master computer via a switchable interface (0 – 10 V DC or 4 – 20 mA) or via Ethernet. The display on the device shows the current and cumulative power consumption.


**Training content**

The variety of stations and the technologies they contain can be used to cover almost all of the relevant topics in control and automation technology.

- Use of RFID technology
- Vision system and camera inspection
- Use of PLCs and programming
- Use of different handling equipment and grippers
- Use of different electric drives
- Vacuum technology
- Pneumatic linear and rotary drives
- Use of fluidic muscles
- Use of laser and colour sensors
- Use of pressure sensors
- Use of industrial robots
- Networking of automated systems with Ethernet TCP-IP
- Visualisation of systems with WinCC
- Use of simulation tools

- WLAN communication
- RFID technology
- Networking with Profibus DP
- Working with autonomous mobile robots
- Programming a mobile robot with GRAFCET
- Creation of functional modules in C++
- Control of drives
- Navigation

# 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' catalogues 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.



### Palletising 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.

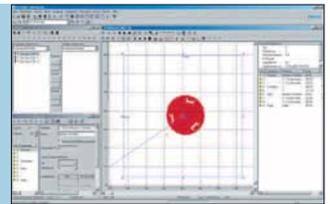


**Configuration, programming and simulation**

No learning system is complete without the necessary supporting software!

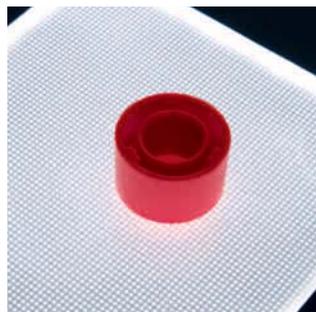
Therefore, the cell includes configuration and image processing software that can be used to set up and perform even complicated measuring and testing tasks.

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 beginning 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, colour identification, for checking dimensions or, for example, for monitoring assembly processes.

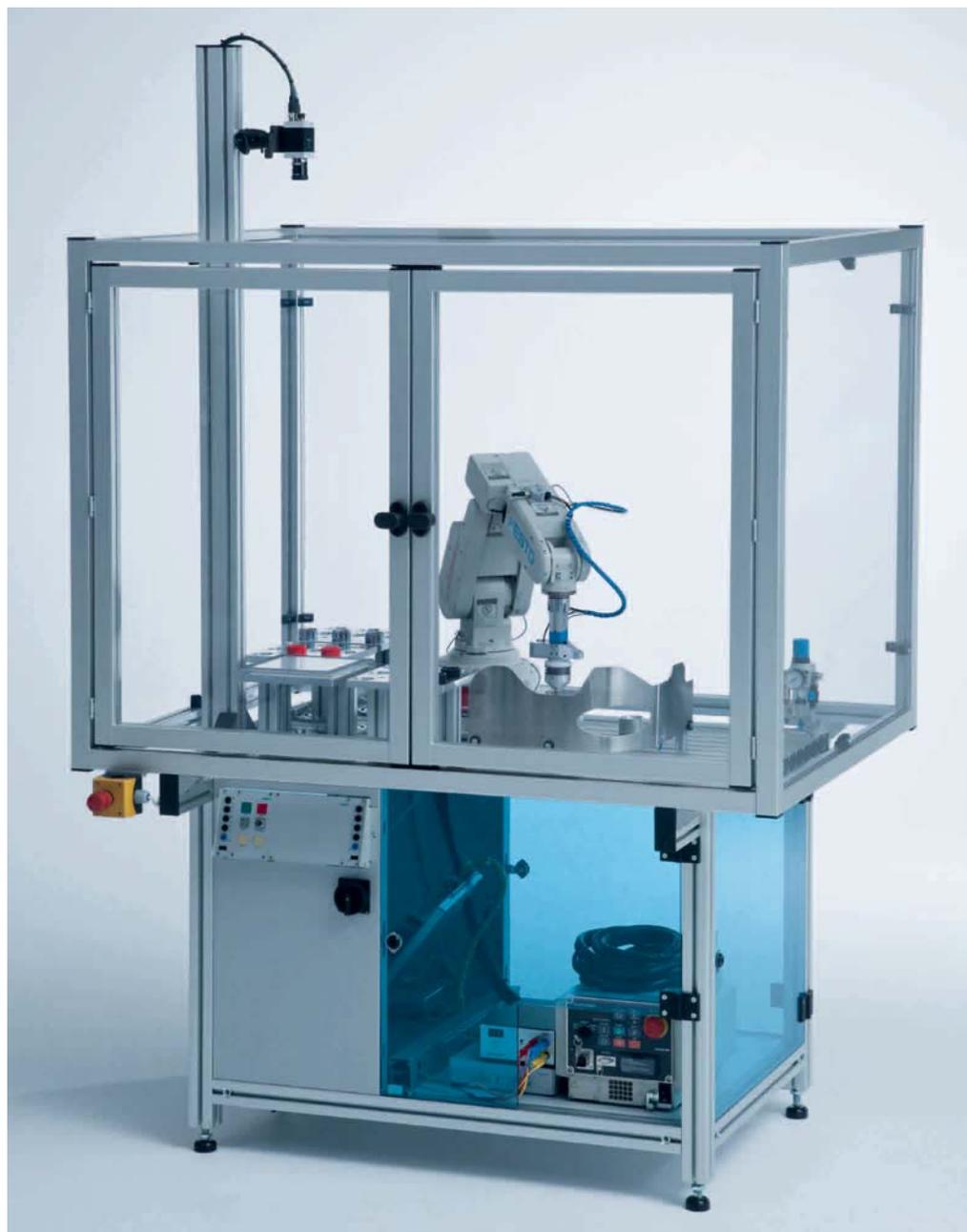


**Calibration and transmitted light unit**

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.

# Robot Vision Cell

## Robotics and vision



### Function

The Robot Vision Cell provides the optimum learning environment for robotics and vision. The clearly arranged pallets and storage areas allow easy and efficient work with the cell. Different exercises such as palletising, assembly or welding (simulated) can be carried out using the cell.

### Construction

The robot cell is completely mounted on an aluminium profile plate. The robot controller is neatly housed in the frame. The station is equipped with a main switch and additional control panel. The safety concept for the cell includes doors with a safety switch and an emergency stop mushroom actuator.

### Robot options

The cell can be fitted with different robot systems, such as the Mitsubishi RV-2SDB or the KUKA KR5sixx.

**Robot Vision Cell RV-2SDB** On request  
 (with base frame, safety housing, camera system and Mitsubishi robot system RV-2SDB)

**Robot Vision Cell KR5sixx** On request  
 (with base frame, safety housing, camera system and KUKA robot system KR5sixx)

**Learning content for project work**

**Mechanics:**

- Mechanical construction of a station

**Sensor technology:**

- Mode of operation and applications of optical sensors

**Vision:**

- Mode of operation and applications of industrial camera systems
- Object detection
- Position and orientation
- Communication with master controllers

**Safety engineering:**

- Mode of operation and applications of safety switches
- Construction of safety circuits

**Robotics:**

- Applications of industrial robots
- Terminology in robot technology
- Teaching robots in different co-ordinate systems
- Moving robots in object co-ordinate system

**Recommended learning media**



CIROS® → Page 43



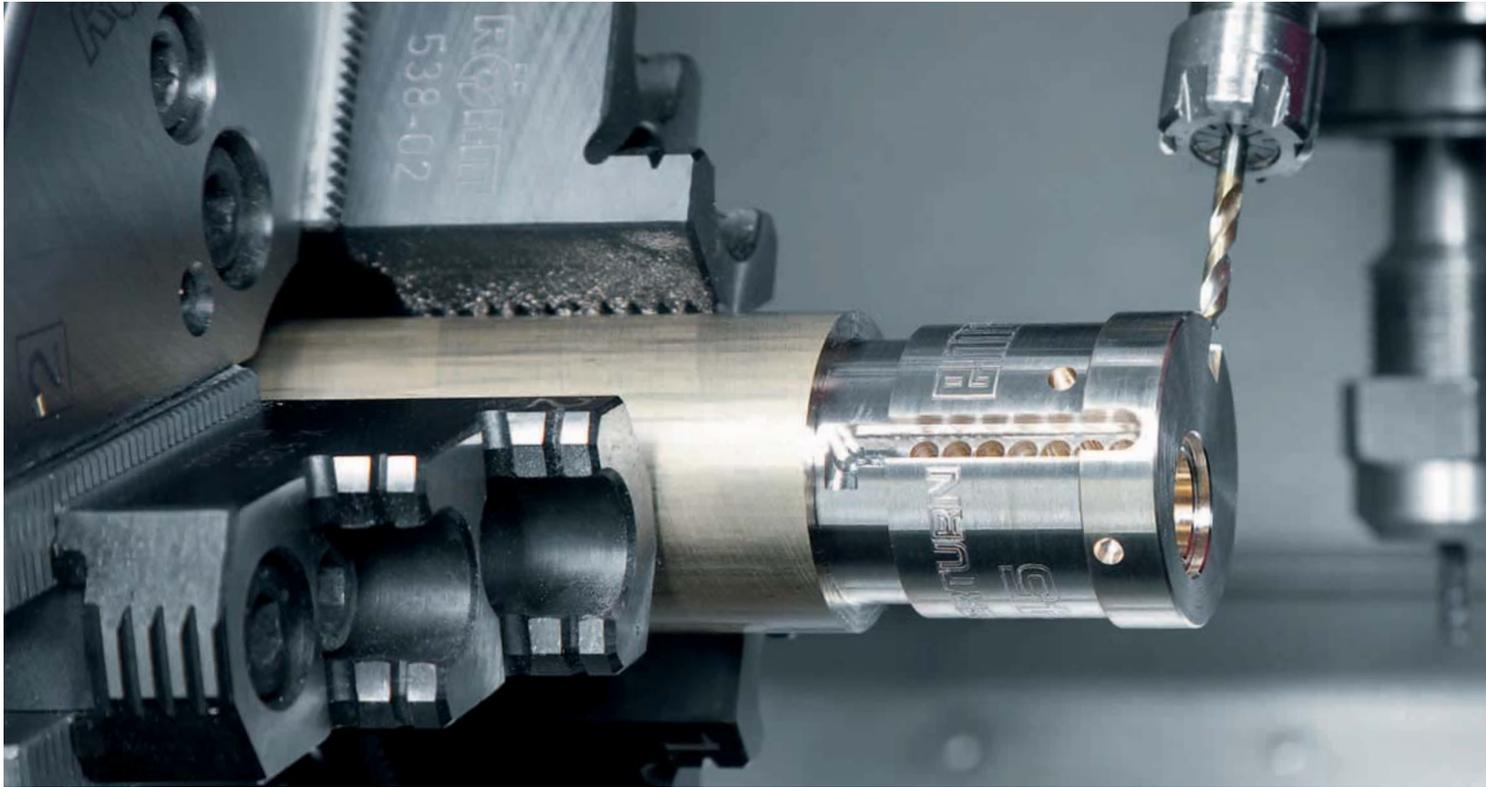
WBT Machine Vision → Page 25



WBT Safety engineering → Page 26

# CNC technology from EMCO

## Efficient turning and milling



### The training programme

Festo Didactic integrates CNC training into its learning system, thus meeting the requirements of modern basic and advanced training in the metal sector. CNC programming and cutting, a key task in many metalworking companies, places high demands on students.



### Market leading CNC technology

The machine manufacturer EMCO offers a unique training concept, consisting of high quality machines, modular software and supporting teachware.

EMCO is Austria's leading machine manufacturer and has been the market leader in CNC training for some years. All machines are tailored to the specific requirements of a training situation: safety engineering compliant with CE directives, variety of controllers, space requirements and price.



### EMCO CNC machines – By the industry, for the industry

EMCO provides intelligent solutions for CNC turning and milling cutting for the industrial sector. EMCO's extensive product range includes everything from conventional turning and cutting machines to CNC turning centres through to fully automatic production cells.



### Perfect solutions for basic and advanced training

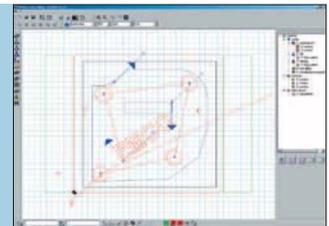
You can benefit from this know-how. EMCO machines for basic and advanced technical training feature:

- Design and quality that meet the current industry standards
- Long service life and consistently high precision of parts produced
- Range and design of functionality corresponding to modern industrial machines

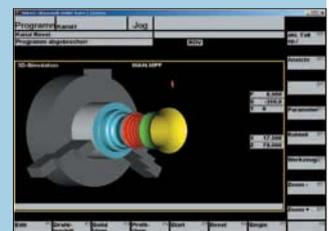


### CAD/CAM and simulation

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.



**Changing controller? No problem!**  
Standard CNC machines are permanently linked to a CNC controller. If you need a different controller for training, this change almost always involves buying a new machine. However, the PC controlled turning and milling machines are different: It is easy to change the controller keypad, load different software and start cutting. This allows you to use all standard industrial controllers on a single machine.



**Individual machine or CNC laboratory**  
The controller software is also available as an offline programming workstation. In conjunction with individually available controller keypads, we will be happy to plan a complete CNC training laboratory for you, with different controllers such as SINUMERIK, Fanuc or HEIDENHAIN.

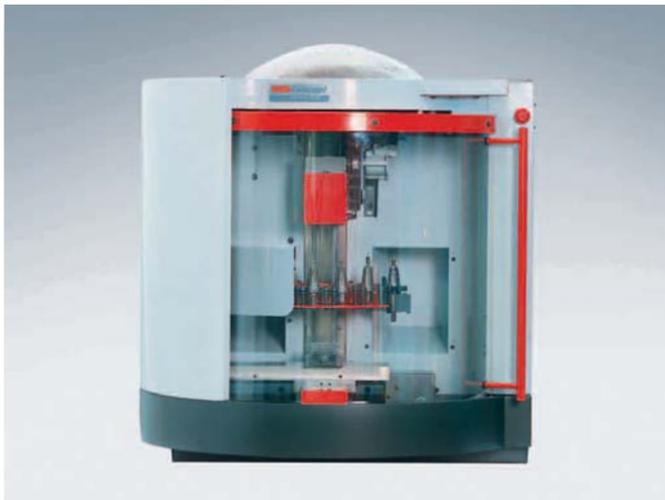
### CNC turning or milling? Which controller and which accessories?

Call us. We'll be happy to help. Festo Didactic is an exclusive distribution and service partner for EMCO CNC training systems in selected countries.

Detailed information can be found on the Internet.

# Concept MILL and TURN

## High-end training solutions



### 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, grey 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 grey cast iron, ensuring the highest precision.

Automation options: integration in the FMS or CIM systems on request.

### Highlights

- Stable, grey cast iron construction, suitable for industrial use
- 10-station tool changer with directional logic
- Backlash-free bearing of the working spindle in precision, lifetime-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
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### Milling machine Concept MILL 250

This is training at the highest level: with 7 kW drive power and a 20-station tool magazine with fast double gripper. Thanks to its stable and compact design, the Concept Mill 250 fits into the smallest of spaces.

Automation options: integration in the FMS or CIM systems on request.

### Highlights

- High drive speed
- 20-station tool magazine
- Stable and compact machine structure
- Best view when fully enclosed
- Crane loading possible
- Servo motor technology in all axes
- USB and Ethernet interfaces

Concept MILL 250	567161
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**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**

Travel rangeThe PC-controlled 2-axis lathe with table format not only easily fulfils 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-dampening, 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 250**

Uncompromising quality right down to the last bolt, at an unbeatable price. With an extremely solid machine base, a thermosymmetric headstock, high-precision spindle bearing, pre-stressed guideways in all axes and a fast tool turret. And the interchangeable EMCO WinNC control unit to top it all off.

Automation options: integration in the FMS or CIM systems on request.

**Highlights**

- Extremely solid machine base, top thermostability
- Highest precision
- Very compact construction
- Interchangeable WinNC control units
- Change between the WinNCs within 1 minute
- Best European machining quality



Concept TURN 250 - B	557440
Concept TURN 250 - T	557441
Concept TURN 250 - TC	557442
Concept TURN 250 - TM	557443
Concept TURN 250 - TCM	557444

# Concept 450

## On the way to series production



### Milling machine Concept MILL 450

Experience machining without equal. The Concept MILL 450 is a complete production machine for CNC milling training: with fixed 20-station tool magazine, a rapid twin-arm changer, a 13 kW and 10000 rpm main spindle, 24 m/min rapid traverse feeds and the EMCO WinNC control concept.

Automation options: integration in the FMS or CIM systems on request.

### Highlights

- Extraordinary dynamics
- Optimum thermostability for maximum precision
- High cutting performance
- Large number of automation options
- Excellent price-performance ratio

Concept MILL 450

563256



### Lathe Concept TURN 450

A new dimension of CNC training suitable for industrial purposes. Equipped with a C axis, driven tools and digital drive systems and components, the function and performance of the Concept TURN 450 is in accordance with state-of-the-art industrial machines.

Automation options: integration in the FMS or CIM systems on request.

### Highlights

- Universal applicability
- Digital drive engineering
- Extraordinary dynamics
- Optimal thermo-stability
- Highest possibility processing accuracy
- Compact machine assembly

Concept TURN 450 - TC

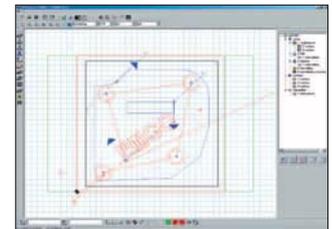
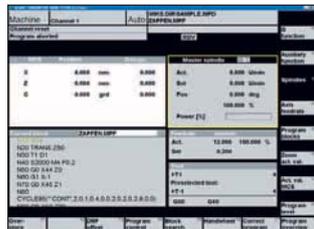
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Concept TURN 450 - TCM

548356

# Software

## The principle of the interchangeable controller



### 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

### Controller keypad

Using the controller keypad (accessory with interchangeable key modules for the relevant controller types) makes operation much simpler and increases the educational value thanks to its similarity with the genuine controller. Includes USB connecting cable.

In addition to the controller keypad, a PC with monitor is required. These are not supplied as standard. A corresponding WinNC licence and a key module is required for each controller keypad. These are not supplied as standard.

Controller keypad

On request

Sinumerik key module

On request

Fanuc key module

On request

HEIDENHAIN key module

On request

### CAMConcept

CAMConcept is an innovative software for complete CAD/CAM and NC training – from design to production. All the core functions of CAD programs are available. Clear graphical CNC cycles allow rapid programming, while 3D simulations and collision checks guarantee reliable program monitoring.

### CAMConcept turning/milling

Network capable CAD/CAM programming system for turning or milling.

CAMConcept

On request

# MicroFMS



## MicroFMS – An introduction to the world of flexible manufacturing and integrated systems

All of the key processes in a fully automated flexible manufacturing system – FMS – can be represented.

- Unfinished parts buffer
- Separation
- CNC machine loading with robot
- CNC machining processes
- Finished parts buffer
- SCADA/DNC options



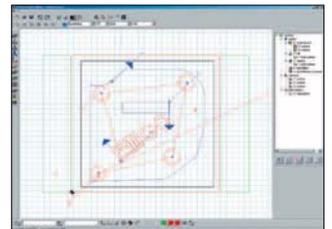
### CNC technology

The CNC machines used are PC controlled tabletop turning machines and/or tabletop milling machines, with a design and function that meets all of the industry standards.



### Industrial robots

Industrial robots with powerful controllers (multitasking, path control) are used for loading and unloading. Because of their modularity and the clearly defined interfaces, the MicroFMS systems can be combined with one another and with MPS® stations.



### Control, programming, simulation:

- Software solutions for MicroFMS**
- Simple CAD/CAM system for turning and milling
  - 3D simulation for turning and milling
  - CIROS®



**Order input and visualisation of the CNC cell**

The cell computer of the CNC cell facilitates input of a number of different CNC orders in one order batch. Each order can start its own CNC program via DNC. You can also define whether an order should involve turning or milling or turning and milling. In addition to order input, the CNC is dynamically visualised using a 3D representation.



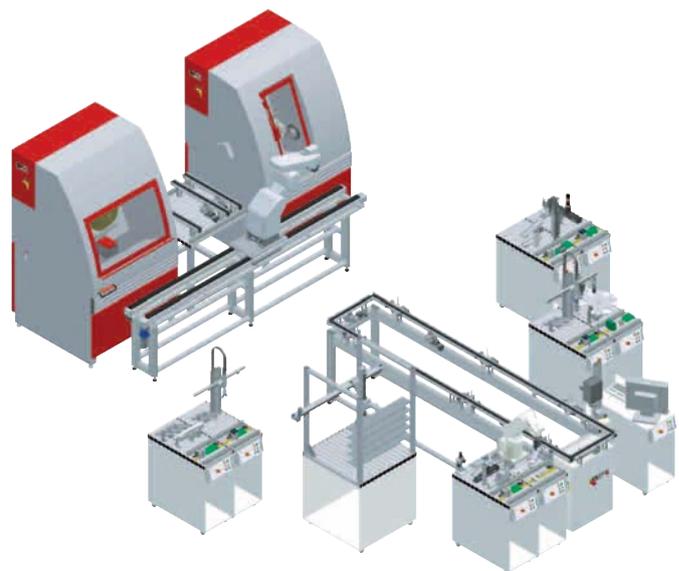
**Many combination options**

The MPS®, MPS® 500- FMS and MicroFMS subsystems can be used either individually or in a network. This gives you a wide range of combination options, totally tailored to your training situation.

The system remains easy to operate, as significant focus has been placed on standardisation, particularly in the design of the interfaces.

**Decentralised control technology**

This makes even large systems easy to operate: each station has a dedicated controller, so that it can be used individually. The stations are synchronised at level 1 (L1) using digital I/Os.



# MicroFMS

## Control and communication principles



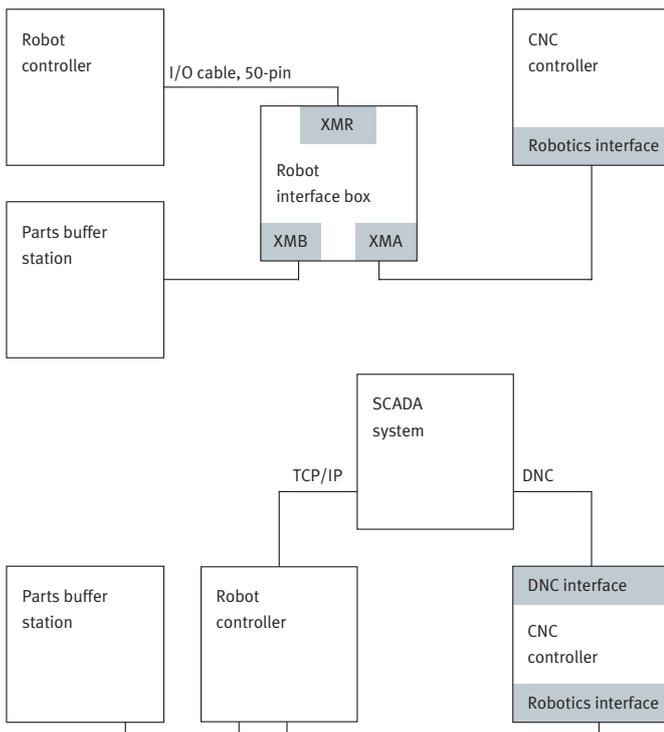
### The control concept

Every CNC machine in MicroFMS has its own PC control system. On the PC, various industrial control systems such as the Sinumerik 810D/840D, Sinumerik Operate, Fanuc or the CAMConceptCAD/CAM system can be installed. Via an optional control panel, the user interface for the corresponding control system can be displayed.

For automated use, the CNC machines are equipped with an automatic door, pneumatic chuck and/or an electromagnetic vice and an I/O communication interface.

### Spectrum of workpieces

The illustrated turned and milled parts can be manufactured for example from unmachined parts with a diameter of 30 or 40 mm.



### Level 1: Automated buffer operation via I/O communication between robot and CNC machine

Central control of the automated buffer operation is provided by the robot controller. Buffer operation is started and stopped via the MPS® control desk at the station robot.

Level 1 enables the automated processing of a buffer of unmachined parts. If different work-pieces are to be made, then the corresponding program must be manually pre-selected at the CNC machine. Communication between a robot and a CNC machine, such as starting and stopping the CNC machining, reporting completion, opening and closing the door, is controlled by the robot controller by setting and reading the I/O lines of the CNC machine robotics interface.

### Level 2: Flexible buffer operation with a SCADA system

Robots, CNC and cell computers as well as an optional CAD/CAM laboratory are all networked together, via Ethernet. The DNC commands are transmitted from the cell computer to the CNC machine via whatever DNC interface is available (RS232 or TCP/IP). Level 2 corresponds to the full functionality of flexible industrial manufacturing systems (FMS). Every unmachined part put in the buffer is assigned to a specific process plan. This means that differing work-pieces can be manufactured in the system. Using DNC, the appropriate CNC programs for the workpiece are loaded into the machine via the cell computer. Optionally, a CAD/CAM laboratory can be networked with the system.

## TR6 – Turned parts with robot loading

TURN 60 is an industry-compatible inclined-bed lathe that facilitates all machining possibilities of a modern CNC turning machine: turning, plunge cutting, cropping and drilling.

### TURN 60

- Turning machine, mounted on table with profile plate:
- 8-way tool turner
  - Clockwise/anticlockwise rotating spindle
  - Infinitely variable main drive (1.1 kW)
  - Constant cutting speed
  - Automatic motion to reference point
  - Pneumatic chuck
  - Automatic door and robotics interface
  - Travel X/Z: 60/290 mm
  - Rapid traverse: 2 m/min
  - Maximum width/maximum turning diameter: 335/60 mm
  - Speed range 300 – 4200 rpm
  - PC control with selectable CNC controller interface

### Parts buffer station

- 2 conveyor belts, mounted on trolley with profile plate:
- Conveyor 1 for buffering and separation of cylindrical unmachined parts size 30 or 40 mm
  - Conveyor 2 for buffering and/or separation of cylindrical finished parts with a base area of at least 30 mm diameter

### RV-2SDB

- 6-axis industrial robot, mounted on trolley with profile plate:
- Reach/payload: 504 mm/2 kg
  - Axis drive: AC servo motors with gear unit from Harmonic Drive AG
  - Repetition accuracy:  $\pm 0.02$  mm
  - Maximum speed: 4400 mm/s
  - Gripper: Pneumatic finger gripper for cylindrical parts with a diameter of 8 – 40 mm
  - Controller: 64-bit RISC processor with multitasking real-time operating system, PTP linear and circular interpolation
  - Teachpanel: dead-man's switch, EMERGENCY-STOP button, robot motion in joint, cartesian and tool coordinates

MicroFMS TR6

On request



### Robot cell

The automatic control and loading/unloading of the CNC machine is undertaken by the 6-axis RV-2SDB industrial robot used in the MPS®. In the Parts buffer station cylindrical unmachined parts are buffered and separately fed to a robot for removal. After CNC machining, the robot removes the finished part and places it on the station's other conveyor belt, where it is either buffered or separated for further transport.

### Controlling, programming, simulating: the software solutions for MicroFMS

- Simple CAD/CAM system for turning and milling
- 3D simulation for turning and milling
- CIROS®

# MR6 – Milling cell with robot loading

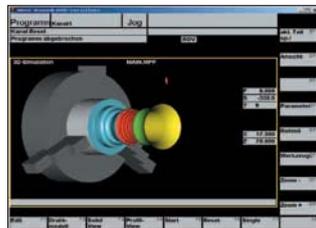


MILL 55 is a 3-axis milling machine of industry-compatible design that facilitates all machining possibilities of a modern CNC milling machine: milling, cutting and drilling/boring.

### MILL 55

3-axis milling machine, mounted on suitable base frame:

- Clockwise/anticlockwise rotating spindle
- Infinitely variable main drive (0.75 kW)
- Automatic motion to reference point
- Electromechanical vice
- Automatic door and robotics interface
- Travel X/Y/Z: 190/140/260 mm
- Rapid traverse: 2 m/min
- Milling machine table clamping area: 420 x 125 mm
- Speed range 150 – 3500 rpm
- PC control with selectable CNC controller interface
- 8-station tool drum (option)



### Robot cell

The automatic control and loading/unloading of the CNC machine is undertaken by the 6-axis RV-2SDB industrial robot used in the MPS®. In the Parts buffer station cylindrical unmachined parts are buffered and separately fed to a robot for removal. After CNC machining, the robot removes the finished part and places it on the station's other conveyor belt, where it is either buffered or separated for further transport.

### Controlling, programming, simulating: the software solutions for MicroFMS

- Simple CAD/CAM system for turning and milling
- 3D simulation for turning and milling
- CIROS®

### Parts buffer station

2 conveyor belts, mounted on trolley with profile plate:

- Conveyor 1 for buffering and separation of cylindrical unmachined parts size 30 or 40 mm
- Conveyor 2 for buffering and/or separation of cylindrical finished parts with a base area of at least 30 mm diameter

### RV-2SDB

- 6-axis industrial robot, mounted on trolley with profile plate:
- Reach/payload: 504 mm/2 kg
  - Axis drive: AC servo motors with gear unit from Harmonic Drive AG
  - Repetition accuracy: ±0.02 mm
  - Maximum speed: 4400 mm/s
  - Gripper: Pneumatic finger gripper for cylindrical parts with a diameter of 8 – 40 mm
  - Controller: 64-bit RISC processor with multitasking real-time operating system, PTP linear and circular interpolation
  - Teachpanel: dead-man's switch, EMERGENCY-STOP button, robot motion in joint, cartesian and tool coordinates

MicroFMS MR6 On request

# MTLR11 – Turning and milling with robot on linear axis

This combination of TURN 105 and MILL 105 facilitates an efficient implementation of a CNC machine production line for turning and milling operations.

## MILL 105

3-axis milling machine with automatic door and robotics interface, mounted on table with profile plate. PC with selectable CNC controller interface for milling machine, on bench.

## TURN 105

Turning machine with automatic door and robotics interface, mounted on table with profile plate. PC with selectable CNC controller interface for turning machine, on bench.

## Parts buffer station

1 station with three conveyor belt buffers, mounted on trolley with profile plate. Conveyor 1 and 2 for buffering and separation of cylindrical unmachined parts size 30 or 40 mm. Conveyor 3 for buffering and/or separation of cylindrical finished parts with a base area of at least 30 mm diameter.

## RV-2SDB

6-axis industrial robot with pneumatic finger grippers mounted on linear axis.

## Linear axis with toothed belt drive

- Stroke length: typically 2000 mm, dependent on layout
- Precise and firm guidance through linear ball bearing
- Drive motor: AC servo motor
- Output: 0.2 kW
- No-load speed: 3000 rpm
- Positioning: Incremental rotary transducer

For further technical details, see MR6 and TR6.



## Robot cell

Automatic control and loading/unloading of the CNC machine is undertaken by a 6-axis RV-2SDB industrial robot that travels on a linear axis. Unmachined parts are fed to the first production process via 2 conveyors. This facilitates feeding of two different unmachined parts, for example aluminium and brass. The workpieces undergo turning and milling in sequence and are then placed on the third conveyor.

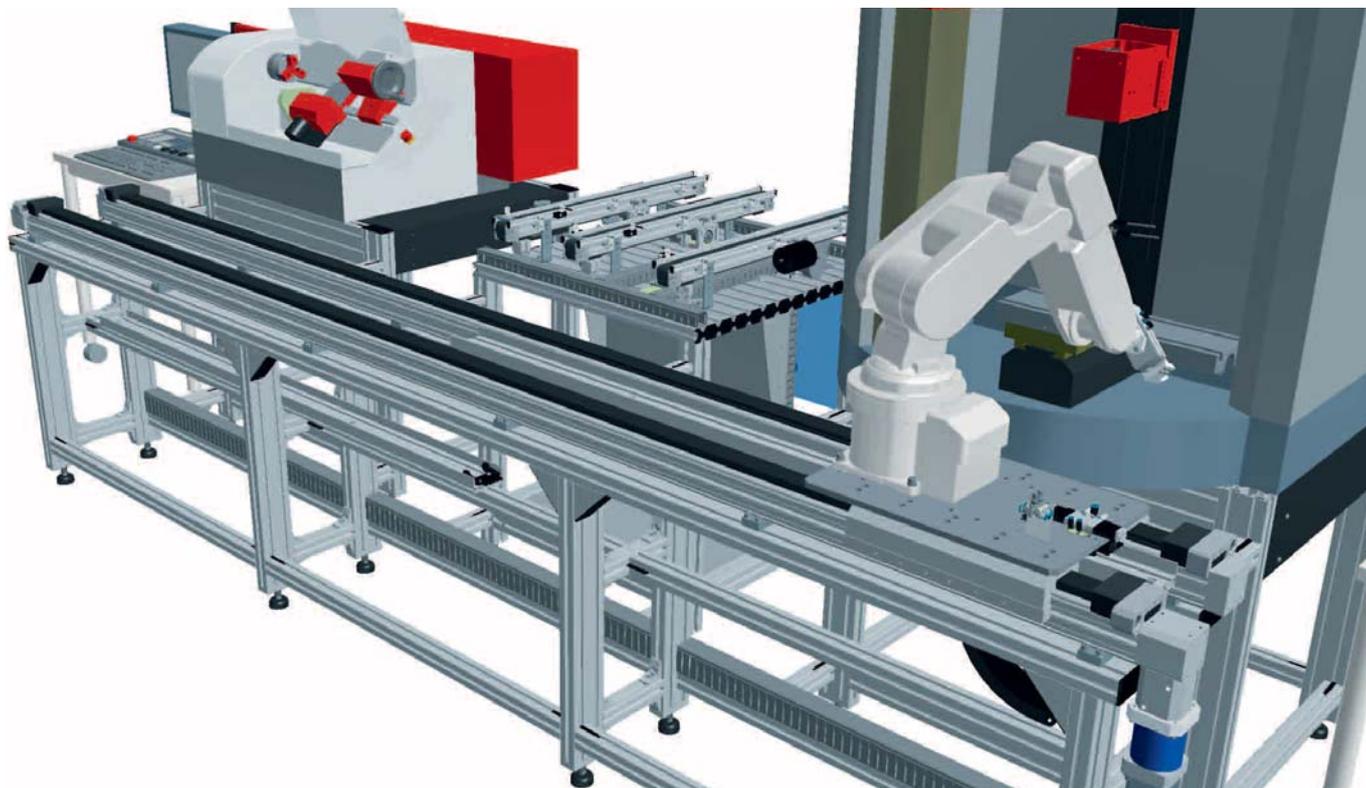
## Controlling, programming, simulating: the software solutions for MicroFMS

- Simple CAD/CAM system for turning and milling
- 3D simulation for turning and milling
- CIROS®

MicroFMS MTLR11      On request

# Customised solutions

## MicroFMS



### 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. That's why a qualified requirements analysis is performed before each MicroFMS 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 goals, 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

Festo's experienced technicians and engineers 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 effective 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.

### Customised 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!

- Communication
- Robotics
- CNC technology
- Simulation
- Vision system
- PLC programming
- Fieldbus
- System simulation
- Troubleshooting

### Upgrade

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

### MicroFMS – CNC production as required

MicroFMS cells can be combined with a wide range of stations, systems and learning factories and focus on CNC technology. One or two machines with a loading robot in networked operation form the core of the learning factory.

The decentralised control concept allows the system to be used as a whole or each system part to be used separately. Therefore, Festo equips each MicroFMS system with separate belt buffers for unfinished parts and finished parts so that sensible and independent material flow is ensured during stand-alone operation.

### Worldwide references

Universities, colleges and vocational training schools around the world are benefiting from the unique MicroFMS system concept. Detailed information on these projects can be found on the Internet:

[www.festo-didactic.com](http://www.festo-didactic.com)  
under the heading Services  
→ References

### CNC technology and mechatronics entry-level solution

Even the small, compact Concept 55 machines can be easily and sensibly combined with all MPS® 500 solutions. The system can also be easily expanded later. Festo will tailor your entry-level solution to your requirements.

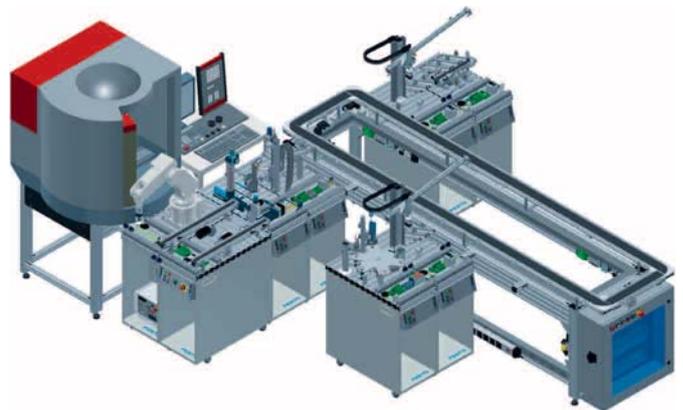
MicroFMS MR5 with MPS® 500-FMS system consisting of:

#### MicroFMS MR5

- 1x Concept MILL 55 with accessories
- 1x loading robot RV-2SDB
- 1x parts buffer station

#### MPS® 500-FMS

- MPS® distributing, testing, handling, processing and sorting stations
- 1x pallet transport system FMF-F
- 1x SCADA system
- 1x programming and simulation package



### Mechatronics learning factory with CNC manufacturing process

The Concept 250 machines enable CNC training at the highest level. All stages of product development can be reconstructed, from CAD design to machining. Up to two industrial robots perform typical tasks such as assembly and loading/unloading of machines in the learning factory. So learning factories of different complexity, tailored to your training needs, can be created in combination with the MPS® 500 systems.

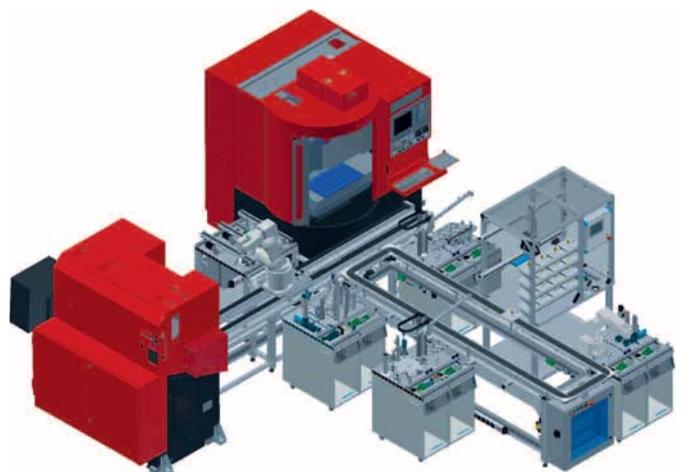
MicroFMS MTLR23 with MPS® 500-FMS system consisting of:

#### MicroFMS MTLR23

- 1x Concept MILL 250 with accessories
- 1x Concept TURN 250 with accessories
- 1x loading robot RV-4FL on a linear axis
- 1x parts buffer station

#### MPS® 500-FMS

- MPS® robot assembly, distributing, testing, handling, processing and sorting stations
- 1x pallet transport system FMF-F
- 1x automatic warehouse
- 1x SCADA system
- 1x programming and simulation package



### CNC technology combined with innovative ProLog factory

The processes and material flow in the ProLog learning factory are a representation of a real production system with logistics and shipping. If the ProLog learning factory is expanded with a MicroFMS system, different semi-finished products can be produced on the CNC machines and automatically fed to the ProLog production line by means of the loading robot in order to cover nearly all areas of automation technology.

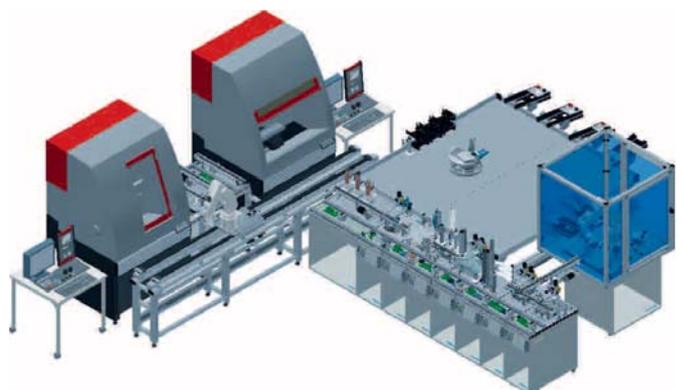
MicroFMS MTLR11 with ProLog factory consisting of:

#### MicroFMS MTLR11

- 1x Concept MILL 105 with accessories
- 1x Concept TURN 105 with accessories
- 1x loading robot RV-2SDB on a linear axis
- 1x parts buffer station

#### ProLog factory

- MPS® distributing 3-way magazine, testing, pick & place, fluidic muscle press, storing, separating and sorting stations
- 1x picking station
- 1x logistics area with mobile robots
- 1x SCADA system
- 1x programming and simulation package



# MPS® Transfer Factory

## From transfer system to convertible factory



### A modular system par excellence

Our decades of experience in the construction of modular learning factories is reflected in many of the details of an MPS® Transfer Factory. All cells and functional modules are equipped with the very latest industrial technology. The concept and equipment demonstrate our innovative approach. The result:

Every MPS® Transfer Factory can be reconfigured in minutes – depending on the learning situation – and turned into a convertible factory.



### 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.



### Added value for PLC training

The modular production system MPS® is primarily notable for its interfaces. The Transfer Factory control panels clearly highlight the value of a cleverly designed interface. For example, the control panels for the individual cells can be equipped with 4 mm safety sockets, simulation switches and a socket for the laptop. This turns the cell in a stand-alone local PLC laboratory.



### Leaning from two sides

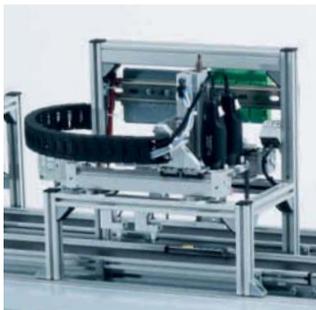
The double-sided construction of the cells facilitates different scenarios for group work:

- Students can work independently on the two sides on one section of the belt each.
- The two belt sections in a cell are linked to form a complete belt rotation system by the workpiece holder routing concept. This results in a complex cell for group work.



**Flexible layout**

The standardised cells 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.



**The content is inside the module**

The individually, variably connectable functional modules determine the learning content on the station. Topics such as drive technology, control engineering, sequencing or operating mode programming can be found in the following functional modules:

- Stacking magazine and turning handling modules
- Drilling and CNC engraving processing modules
- Press module
- Pad printing and drying modules
- Camera inspection testing module



**Systematic modularity**

MPS® Transfer Factory – the name is an accurate description. The basic features of the MPS® transfer system characterise the appearance of the system.

- Wide transfer belt for pallet transportation
- Functional modules above the belt
- Variable system layout, providing freedom for designing individual, partner and group workstations

# MPS® Transfer Factory

## The concept in detail



### Intelligent grid

The cell grid enables different production layouts to be set up so that simple, straight production lines, branches or corner arrangements (90°) can quickly be realised. Individual cells can be replaced in a matter of minutes. The production line in an MPS® Transfer Factory system is actually a convertible factory.

### Cells on wheels

All MPS® Transfer Factory cells are equipped with rollers. This enables them to be freely positioned in the laboratory without tools or lifting trucks.

### Optimum connections

The cells are supplied by a special system cable. Rewiring, fitting new tubing or additional installations are not required when changing the layout. This saves valuable training time and the laboratory remains free of additional supply ducts and trip hazards.

### RFID process control

The product performs process control in the MPS® Transfer Factory. To achieve this, the workpieces and controllers are equipped with RFID technology.

### Modular control concept

The controllers in the MPS® Transfer Factory cells have a modular design. All control components are housed in the cell control cabinets:

- Controllers with Profibus or Profinet networking
- ProfiSafe components
- Drive components such as frequency converters, contactor controllers and servo controllers

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

**Systematic variety**

The exceptional flexibility of an MPS® Transfer 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.

A single cell provides two conveyor sections and thus represents the basis for a complete subsystem.

The production cell with branch opens up the door to new layouts. It can be used as an independent system and be fitted with all functional modules.

The robot cells are equipped with everything necessary for industrial robotics training. Completely enclosed and with safety doors, they provide totally safe working: Hot topics such as camera-supported assembly, the use of interchangeable gripper systems, palletising, camera tracking etc. can be dealt with in a practical way using a robot cell.

There are hardly any limits on how the cells can be combined and the possible layouts. The functional modules available now and in the future make every MPS® Transfer Factory into a learning system with the best opportunities for the future.



# Customised solutions

## MPS® Transfer Factory



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- PLC programming
- Fieldbus
- RFID technology
- System simulation
- Troubleshooting

### Upgrade

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### MPS® Transfer Factory – the modular mechatronics system for learning factories

Festo's years of experience in designing mechatronic learning systems were the inspiration for creating a modular system for excellent mechatronics training. Not only mechatronics technicians benefit from the system flexibility.

The MPS® Transfer Factory is used as a learning platform for production and automation technology, robotics, and of course mechatronics.

### Worldwide references

Universities, colleges and vocational training schools around the world are benefiting from the unique MPS® Transfer Factory system concept. Detailed information on these projects can be found on the Internet:

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### Learning factory and mechatronics laboratory

Four trainees – two on each side – can work at one basic cell without trouble. The six basic cells thus allow all relevant mechatronics fundamentals to be taught to up to 24 trainees at the same time in the field of PLC programming, drive technology, sensor technology, and safety engineering. The topics of handling technology, robotics, vision systems, RFID and quality assurance are reinforced with the production modules and the automatic warehouse.

Mechatronics technicians are successfully trained using this concept at BBS Brinkstraße in Osnabrück.

### Learning factory for production engineering

A complete production process can be easily modelled using the MPS® Transfer Factory cells. Many different assembly lines can be quickly created just by rearranging – no reprogramming necessary! The learning factory demonstrates typical topics and methods for planning and optimising production, as well as value stream analyses and value stream mapping, in practical applications.

Beginning engineers at the Hochschule Fulda already benefit from this concept on their MPS® Transfer Factory assembly line.

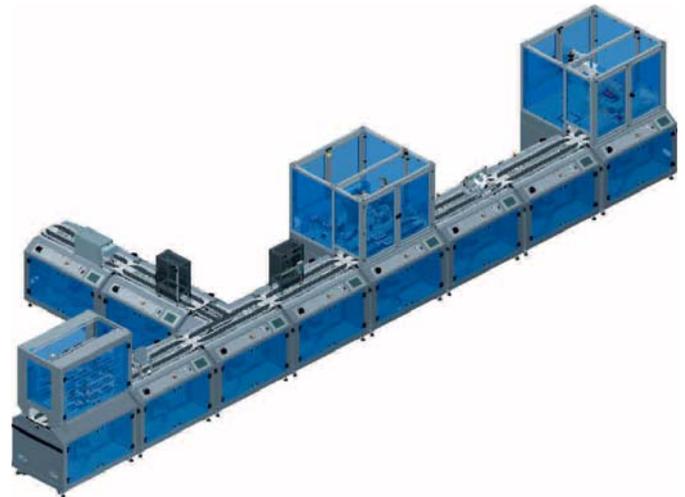
### Robotics laboratory

A complete, cellular robotics laboratory with a wide range of robot types can be created with the MPS® Transfer Factory. Each cell is operated in stand-alone operation or in combination with several cells.

With the MPS® Transfer Factory robotics, DHBW Mannheim allows its students to simulate, program and commission various robot systems.

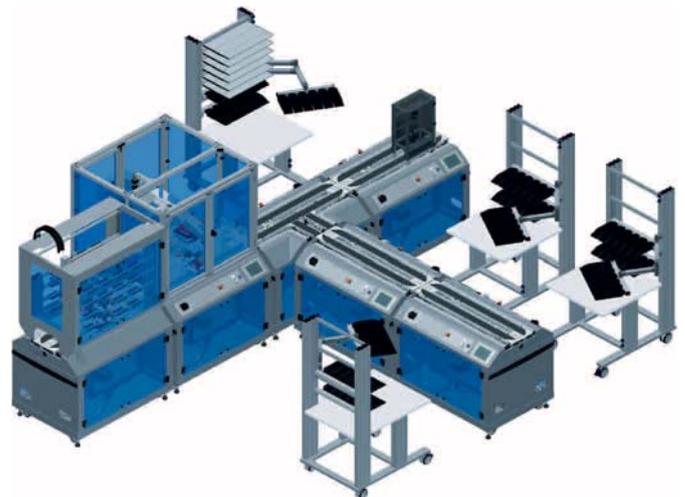
### MPS® Transfer Factory mechatronics consisting of:

- Application modules: magazine, drilling, vision inspection, turning, printing, drying
- 6x basic module
- 1x automatic warehouse
- 1x robot assembly cell with 6-axis articulated arm robot RV-4FL with gripper exchange system and camera support
- 1x robot picking cell with SCARA robot
- 1x SCADA system
- 1x programming and simulation package



### MPS® Transfer Factory assembly line consisting of:

- 3x basic module
- 1x branch module
- 4x manual workstation
- 1x vision inspection module
- 1x automatic warehouse
- 1x robot assembly cell with 6-axis articulated arm robot RV-2SDB with gripper exchange system and camera support
- 1x SCADA system
- 1x programming and simulation package



### MPS® Transfer Factory robotics consisting of:

- 1x robot assembly cell with 6-axis articulated arm robot RV-4FL with gripper exchange system and camera support
- 1x robot picking cell with SCARA robot and belt tracking function
- 1x automatic warehouse with Cartesian robot system
- 1x SCADA system
- 1x programming and simulation package



# iCIM – The platform for professional interdisciplinary CIM training.



## **iCIM – the platform for research and training**

iCIM systems play an important role in illustrating complex topics such as production logistics and sequence planning in flexible manufacturing systems (FMS):

- Material supply and disposal
- Planning algorithms for automated production lines
- and much more.

The exclusive use of open standards for communication and databases as well as the modular structure of the software provides numerous possibilities for realising your own ideas.

The interface between iCIM-ERP and iCIM-MES has been published. With suitable programming skills you can link the iCIM system into your existing PPS or ERP system.

A world of possibilities awaits – why not find out more?

### **Interdisciplinary with iCIM**

Future technicians and engineers, but also sales staff and management, benefit from interdisciplinary training on iCIM systems. From the fundamentals of mechatronics to complex networked processes, the relationships between individual processes are illustrated in a clear and comprehensible way.

## **iCIM software – all of the tools that you need for effective planning and engineering**

### **MES**

Planning is one thing – production is another. The MES in iCIM brings planning and production together. Using the CIROS® integration tool as a basis, we create and supply an open and modular MES solution for your system which you can modify if necessary. The wide range of standard interfaces means that virtually all automation devices can be integrated, which is an important consideration for those system components you already own.

## **Programming tools**

We offer practical programming tools for each iCIM system for programming and setting the parameters for PLCs and robots. Cost-effective multiple licences for classroom scenarios are available for almost all packages.

# With perfectly matched software. For effective planning and engineering.

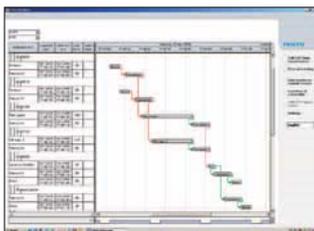
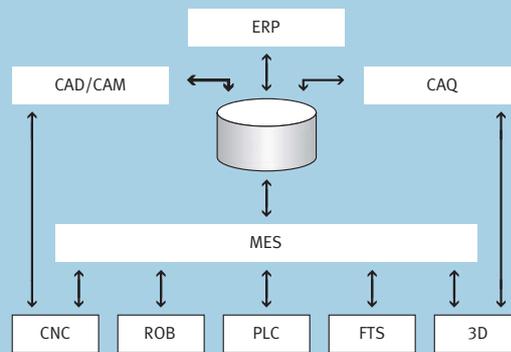


## The fascination of CIM

Computer-integrated manufacturing (CIM) provides an impressive display of what can be achieved with current technology:

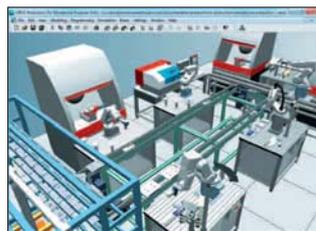
PCs, robots, programmable logic controllers and CNC machines communicate via networks. Processes are optimised through simulation, a whole host of production data is ad-

ministered and made available in databases. Just about every process is “integrated”, which means individual processes can no longer be considered in isolation. This requires all those involved in the production process to have an in depth understanding of the relationships between these individual processes.



### PPS/ERP

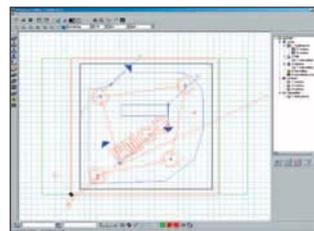
How does a company function? Every company is certainly unique, but there are common aspects: Entering and managing customer data, entering and maintaining basic data, defining machines with their costs as manufacturing resources, maintaining parts lists. This gets really interesting when manufacturing orders are placed. How does the material availability look? Can the delivery dates be met? **iCIM ERP** is an industrial ERP system, which is optimised for iCIM systems and offers all commonly used functions and reports.



### Virtual reality and 3D simulation

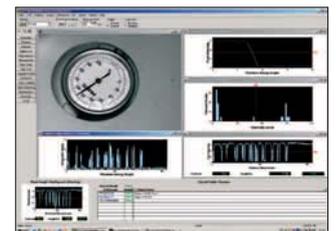
Creating and testing manufacturing processes on a PC – this is easy in the CIROS® virtual factory environment. Assemble a production line from the module library, create the matching MES project with one mouse click, enter the process parameters and start the process. The 3D simulation now clearly illustrates the procedure, with real robot programmes running in the simulated robots.

Just like a real system, the virtual systems can also be connected with iCIM ERP.



### CAD/CAM

CAMConcept from EMCO is a CAD/CAM system for turning and milling applications with integrated 3D graphic simulation. Design simple parts using the integrated CAD functionality and then create your CNC program – you don't even need any controller-specific CNC knowledge.

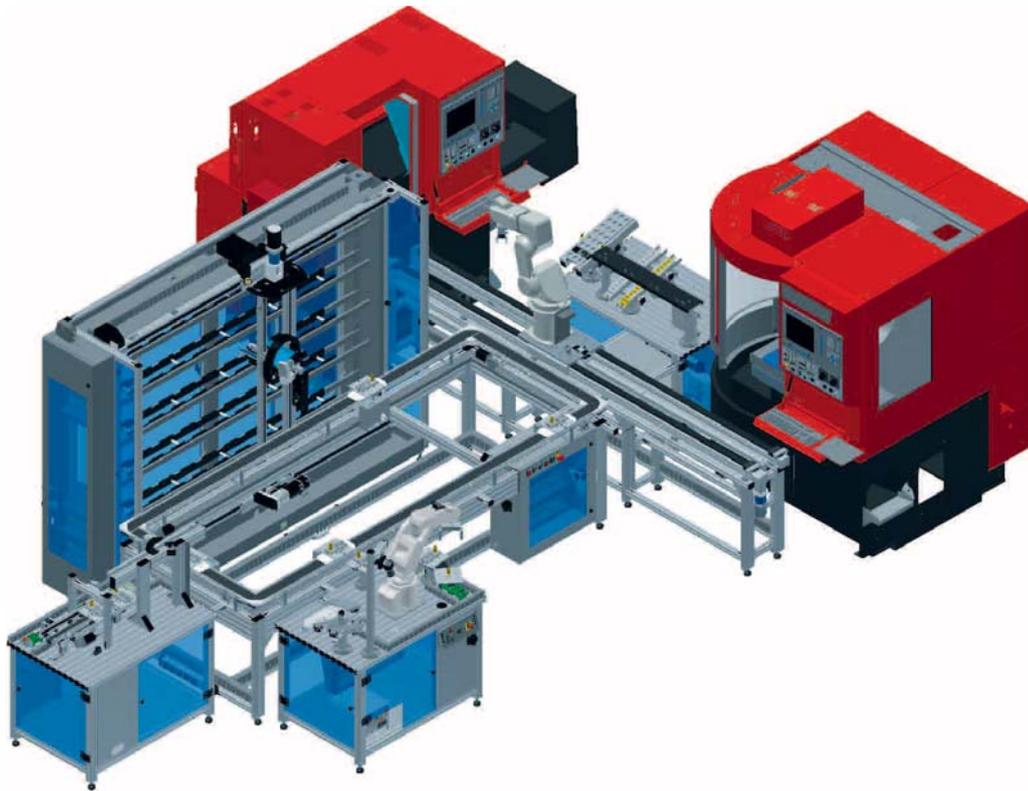


### Quality assurance

Industrial vision systems are increasingly becoming as important as verniers and probes. However, a sound knowledge of image processing and in particular lighting technology is required to design a vision application. Our intelligent compact camera provides all of the functions of a modern vision system and is ideal for both beginners and professional users.

## iCIM 3000

### The complete training system with potential



#### **iCIM 3000 system description**

Automatic warehouse, assembly station, testing station and CNC machines are combined into a flexible production system using a pallet transport system. Each station removes its designated pallet from the conveyor, processes the materials upon it and then replaces it on the conveyor. The cell computer coordinates control of the pallets to the workstations and their start in accordance with the planned process.

#### **Control technology and communication**

Each individual station has its own controller and can therefore also be used on its own for training purposes. In accordance with the latest technological trends, networking of the system is performed using Ethernet to ensure open interfaces and extendability.

#### **Flexible system design**

The unique object-oriented approach of the iCIM systems facilitates maximum flexibility when it comes to designing systems. The stations are positioned along the conveyor based on the space available – you decide the configuration. We also optionally supply transport systems in special sizes or with sorting gates and alternative tracks.

#### **Training included**

With iCIM 3000 you are not just purchasing an excellent training platform – you are also purchasing qualified training by our experts, the purpose of which is to equip you for the continued use of the system. The step-by-step training introduces the subsystems and their interfaces. Once you get to that stage, integrating them into a complete system is virtually child's play.

#### **Training aims:**

- Industrial communication and networks
- Cell control and process planning
- System and robot simulation
- PLC and fieldbus technology
- Positioning technology and servo drives
- Handling and robot technology
- CNC programming and simulation
- CAD/CAM and DNC
- Pneumatic and electropneumatic components

**iCIM 3000 complete package:**
**iCIM stations**
**Pallet transport system**

- Dimensions LxW: 3000 x 1000 mm
- Transport height/track width: 788 mm/80 mm
- Working positions: 4, can be extended later
- Controller: S7-300

**Automatic warehouse**

- Dimensions: LxWxH: 2380 x 1300 x 1800 mm
- Number of stock locations: 40/50
- Shelf robot: linear, X/Y/Z, DC servo, axis of rotation
- Controller: S7-300

**Robot assembly cell**

- Dimensions LxW: 1100 x 700 mm
- Pallet buffer/magazine: 4/3
- Robot type/payload: 6-axis, 2 kg

**Loading robot for CNC machines**

- Robot type/payload: 6-axis, 3 kg
- Linear axis (7th axis): 2500 mm travel
- Pallet buffer/magazine: 4/3

**CNC processing centre, series 250**

- Travel X/Y/Z: 350/250/300 mm
- Output: 7 kW
- Tool drum: 20-station
- Controller type (PC controller): Sinumerik 810D/840D

**CNC turning machine, series 250**

- Travel X/Z: 100/300 mm
- Output: 5.5 kW
- Tool drum VDI 16: 12-station
- Controller type (PC controller): Sinumerik 810D/840D

**Quality station with handling device**

- Travel X/Z: 450/80 mm
- Measuring principle: tactile/analogue/linear variable differential transformer
- Measuring range/accuracy: 28 – 32 mm/± 0.1 mm
- Controller: S7-300

**Software:**
**CIROS® Automation Suite**
**For cell control**

Powerful MES software comprising the modules Visualisation, Process control, Process connection, Database and Simulation.

**For 3D system simulation**

For simulation of the iCIM systems in a virtual reality environment. iCIM station library. User-friendly layout editor. Fully compatible with the non-virtual iCIM system.

**For 3D robot simulation**

For programming robots in a virtual cell environment. Ideal for offline robot training. Extensive cell library. Realistic sequence simulation. Sensor simulation.

**For robot programming**

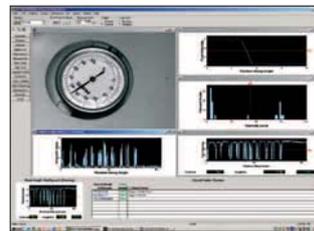
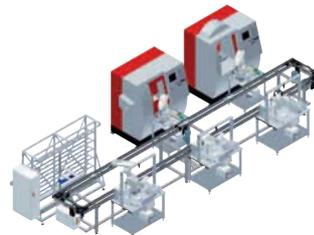
Programming package for Mitsubishi robots.

**CAMConcept CAD/CAM software package, multiple licence**

Simple CAD/CAM system for turning and milling applications with 3D graphic simulation.

**Commissioning/training package**

Commissioning and initial training (in Germany), delivery of the system. Set-up and commissioning at the delivery location. Expert initial training (4 days) for up to 4 persons.


**Upgrades and optional packages:**  
(not included in the scope of delivery)

**Upgrades/modifications**

Whether further stations, modified system layouts or integration of existing system parts – we are happy to address any special requests you have in the area of control technology. Why not benefit from our experts' many years of experience?

**Robot Vision optional package (V1)**

Industrial CMOS compact camera with integrated illumination and Ethernet interface. Resolution 640 x 480 pixels. Stable stand with tilt adjustment. The camera determines the gripper parameters for the robot assembly station. Includes professional image processing software.

**CNC option**

We are happy to offer you iCIM 3000 with alternative robots and CNC machines:

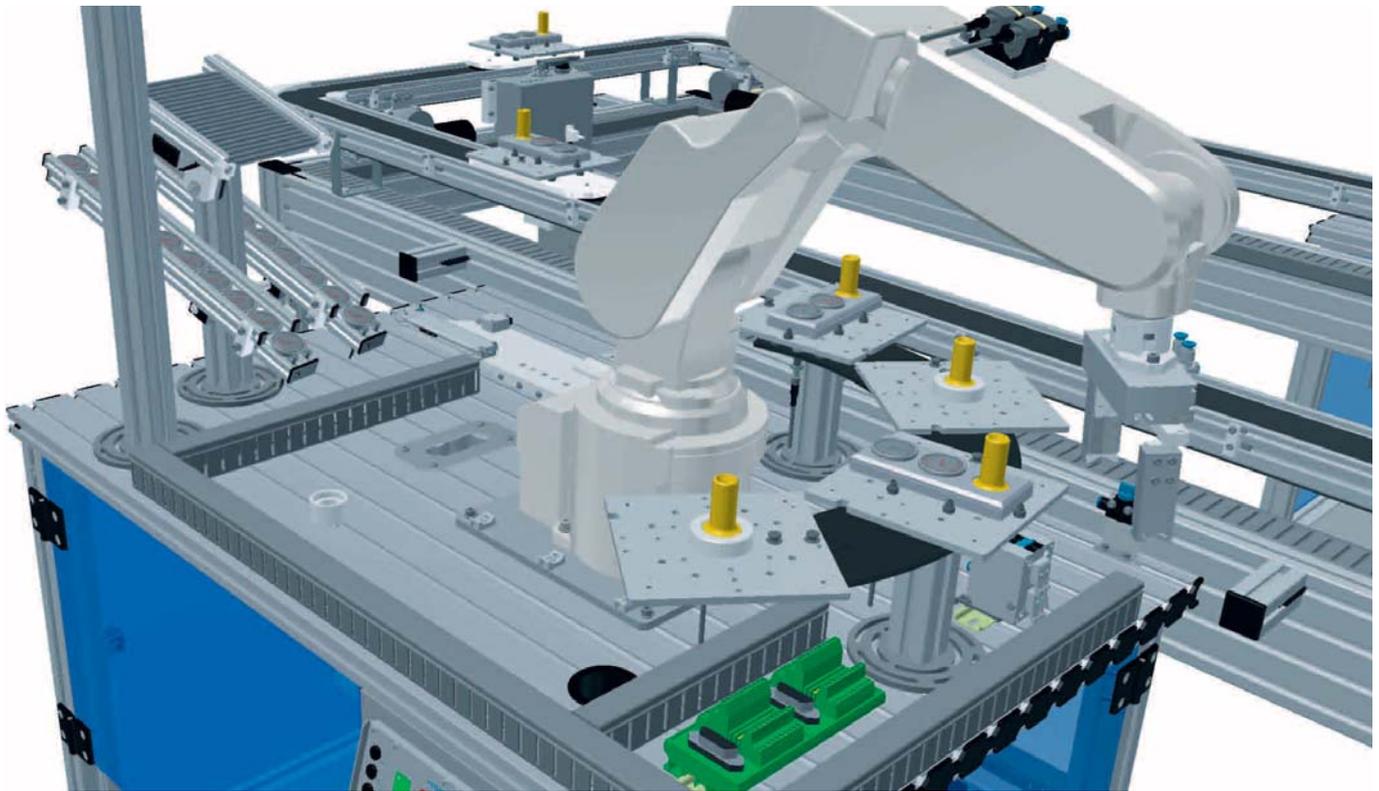
- (C1) CNC machine, series 55
- (C2) CNC machine, series 105

**Robot option**

- (A2) 6-axis assembly robot, 3 kg
- (A3) SCARA assembly robot, 6 kg
- (F2) 6-axis loading robot, 2 kg

# Customised solutions

## iCIM engineering service



### 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. That's why a qualified requirements analysis is performed before each iCIM 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. 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

Festo's experienced technicians and engineers 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 effective 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. This protects earlier investments.

### Customised 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:

- ERP/PPS
- MES
- Communication

- Robotics
- Simulation
- Vision system
- CAD/CAM, CNC
- PLC programming
- System simulation

### Upgrade

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

### iCIM – as varied as factory automation

Hundreds of installations across the globe have given rise to various solutions that are ideally suited to interdisciplinary basic and further training in the area of factory automation and CIM:

### Automatic warehouse

With 16, 40, or 88 stock locations

### Robot assembly

With 6-axis robot, 2 or 3 kg load  
With 4-axis robot, 6 kg load

### Numerous CNC machines

**Loading robot for CNC machines**  
With 6-axis robot, 2 or 3 kg load

### Quality assurance

Using analogue sensors  
Using 3D measuring machine

### Driverless transport systems

### Worldwide references

Universities, colleges and vocational training schools around the world are benefiting from the unique iCIM system concept. Detailed information on these projects can be found on the Internet:

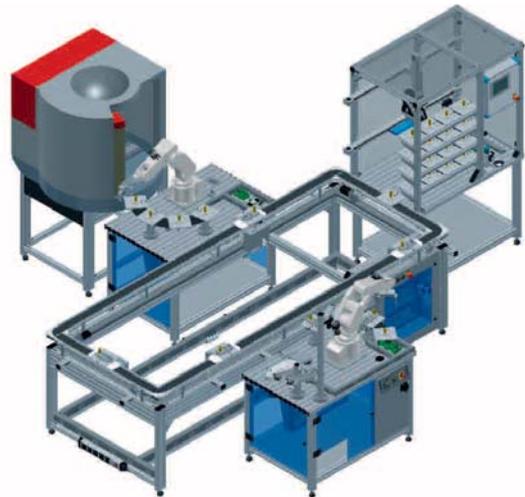
[www.festo-didactic.com](http://www.festo-didactic.com)  
under the heading Services  
→ References

**From entry level ...**

An iCIM system can be created with just a few modules. The system can be easily expanded later. Festo will create your customised entry-level Computer-Integrated Manufacturing system according to your requirements.

**iCIM entry-level solution consisting of:**

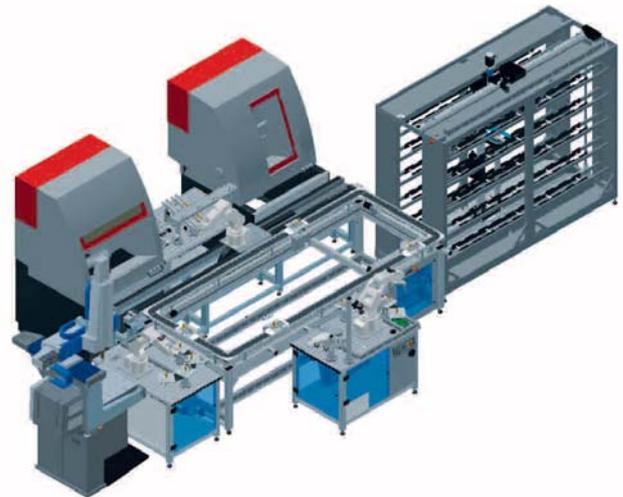
- 1x pallet transport system 1 x 3 m
- 1x automatic warehouse with 16 stock locations
- 1x Concept MILL 55 automated CNC machine with RV-2SDB robot loading
- 1x robot assembly cell with RV-2SDB
- 1x CIROS® cell control
- 1x programming and simulation package

**... to the integration of a wide range of technologies ...**

The iCIM production cells can be equipped with numerous robot systems. Additions such as camera or storage systems and complete coordinate measuring machines for quality control can be used without trouble. Festo's automation specialists are happy to assist you with your desired integration.

**iCIM CNC, CMM and robotics learning factory consisting of:**

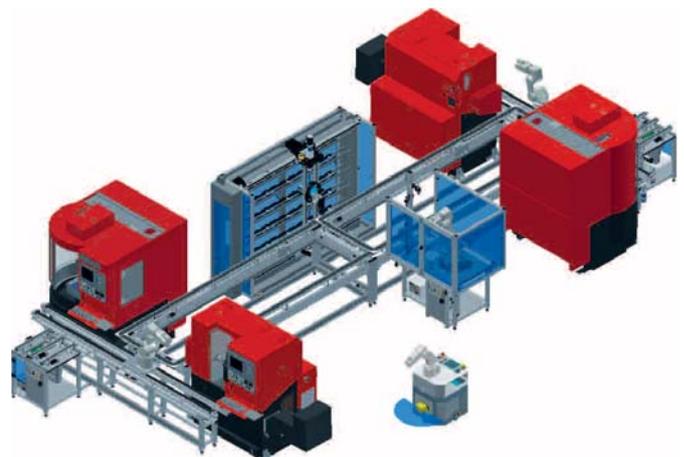
- 1x pallet transport system 1 x 3 m
- 1x automatic warehouse with 88 stock locations
- 1x Concept MILL 105 and Concept TURN 105 automated CNC machines with RV-2SDB robot loading on a linear axis
- 1x robot assembly cell with RV-2SDB and vision system
- 1x CMM coordinate measuring machine with RV-4FL robot loading
- 1x CIROS® cell control
- 1x programming and simulation package

**... to the completely module research platform.**

iCIM is already used successfully in many universities and research facilities. Research topics such as the optimisation of chip-removal processes in the "CIP Process Learning Factory" at the Institute of Production Management, Technology and Machine Tools (PTW) of TU Darmstadt or human-machine cooperation in the "Cognitive Factory" at the Institute for Machine Tools and Industrial Management (iwmb) at TU München can be demonstrated on iCIM solutions. Festo is driving new trends and ideas and would be happy to work with you professionally on your next research project.

**iCIM research platform consisting of:**

- 1x double-belt transport system 1 x 8 m
- 1x automatic warehouse with 50 stock locations
- 2x Concept MILL 250 and Concept TURN 250 automated CNC machines, each with RV-4FL robot loading
- 1x robot assembly cell with RV-4FL and vision system
- 1x AGV driverless transport system
- 1x CIROS® cell control
- 1x programming and simulation package



# iFactory

## Training factory for production planning and factory organisation



### Innovation inspired by challenges

#### Need to convert an entire production line during lunch?

Reacting to new market demands at short notice – is it even possible?

#### What's the best way to construct a flexible production line ...

... so that you can react quickly to market turbulence?

#### Realising dreams

The iFactory is the convertible training factory everyone dreams of, not just production planners. The iFactory has a systematic modular construction, enabling you to try out new ideas immediately realistically.



#### Convertible and modular

The adaptability of the iFactory makes modification simple and enables you to create completely new production layouts in just a few moments. Simple and clear interfaces make for intuitive handling and operation – the key to creative production planning and engineering.



#### Variable production

The iFactory training factory produces different table sets according to each individual customer order. RFID technology in the workpiece holders enables each stage of the production process to be tracked.

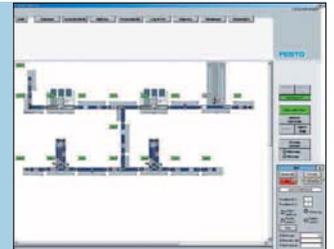
Many different variants of the product can be produced by varying the material and the mounting position used. This means you can use the iFactory training factory to examine and train the complexity of a modern production process – right down to batch 1.



**Pathfinder**

All production cells are equipped with topology feedback so that the master computer – an SQL server – automatically recognises the constructed production line.

All system settings and configurations are generated automatically while arranging and connecting the iFactory cells.



**Intelligent network**

The SCADA system includes a PC with a control cabinet and its own control system. All cells are networked using the SCADA system. In addition to order input, it allows complete operation and monitoring of the entire production line.



**Industrial quality without compromises**

All production cells are constructed professionally and to industrial standards, with no compromises. Training in the factory reflects industrial reality, whether at a manual workstation, in the warehouse or at a fully automatic robot work cell.



**Quality tested**

It's not just the products produced using the training factory that are subjected to constant quality testing. All iFactory production cells are also assembled, wired, programmed and thoroughly tested before use.

# The modules



**The convertible training factory**  
Production cells such as conveyors, deflectors and a wide variety of assembly and quality inspection cells make up the modules in the iFactory convertible factory. The modules contain the latest automation technology such as a range of different drives, assembly robots and handling and image processing systems.

By simply combining these elements you can create any type of production line and expand it whenever you wish.

## References: University of Stuttgart, IFF



The Institute for Industrial Manufacturing and Management or IFF (Institut für Industrielle Fertigung und Fabrikbetrieb) and Festo Didactic have developed an innovative learning environment for advanced Industrial Engineering (aIE). This forms the foundation of an excellent post-academic, basic and further training programme for industrial engineers already working in the industry, i.e. technical managers, planners and designers of production processes.

“If a company wants to ensure its survival and its competitiveness, it is absolutely essential that production planners and those responsible for factory organisation learn how they can react to market turbulence without interfering with existing production runs,” states Professor Engelbert Westkämper, head of the IFF at the University of Stuttgart and the Fraunhofer Institute for Manufacturing Technology and Automation (Institut für Produktionstechnik und Automatisierung, IPA).

The area referred to until now as “industrial engineering” – essentially work and process planning – must be linked in the future with the tools of the digital factory and modular production systems in order to improve adaptability. The use of innovative technology within the digital and virtual factory can further increase the potential for optimisation. This is what the Stuttgart production researchers call “advanced Industrial Engineering”.

The need to be able to continually optimise factories and production systems for the future is massive. However, the range of options currently available for further training which focuses on aIE and is practice-oriented is no longer sufficient. That is why Professor Westkämper initiated the innovative training factory. It uses a unique and novel combination of methods to convey knowledge: a physical model factory, a digital learning island and theoretical modules.

Universität **iff**  
Stuttgart  
Institut für Industrielle  
Fertigung und Fabrikbetrieb

## Process automation and closed-loop control technology





## MPS® PA – The Modular Production System

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# Water – Bulk materials – Chemicals – Energy

## Training in process automation



### Didactic and methodology standards

Practical training on actual production and industrial systems is rarely possible, which is why models are used. These must be realistic and be tailored to different target groups.

You will find that the modular projects, stations, systems and learning factories from Festo Didactic meet these requirements.

### Modularity and integration in MPS® PA

The MPS® PA would not deserve its name if it was not actually a system with modular equipment for basic and advanced training in process automation. In the MPS® PA you will find simple systems for introducing measuring technology and closed-loop control, as well as systems for the designated target groups.

The great thing about it is that all systems are compatible and supplement one another, and they are 100% compatible with all other components of the modular production system.

- Start with the EduKit PA
- Set complex exercises with the MPS® PA Compact Workstation
- Enjoy the variability of the MPS® PA stations
- Design sophisticated projects with the PA 204 complete MPS® system or a hybrid learning factory



**Learning software: Supporting every stage of learning**  
The ideal system for anyone focused on processes and automation: How does a filling system for lemonade work? And what needs to be taken into account when designing and constructing this kind of system?

These and other questions in the area of process automation are answered by the Basic principles of process automation self-study program. This could be used right at the beginning of a series of courses and provides a motivating introduction to the process industry in general schools.



**Energy efficiency: Today's issues for tomorrow's world**  
Control engineering is not simply a topic in a list of learning objectives in automation technology. Without control, there is no chance of increasing efficiency, no chance of preventing energy from being wasted and no sustainability.

This is why the MPS® PA includes modern performance measurement components. This enables energy efficiency to be clearly represented and put into an interdisciplinary context.

**Industry-oriented basic and advanced training**

MPS®PA is based on industry standards. Automation solutions and trends from market leaders characterise the MPS® PA concept. From manual control to a fully automated bottle filling system.

In a learning environment like this, training courses can be designed for every level of training: From general technical training through to basic and advanced training for technicians and engineers.



**EduKit PA:  
Introductory projects**

The EduKit PA is ideally suited for small budgets, restricted space or an initial introduction to measuring technology and closed-loop control. The interaction of technology, software and structured teachware fits seamlessly into both professional training and general technical training.



**MPS® PA Compact Workstation:  
All processes in one system**

Anyone who is looking for more than one control loop to provide the greatest possible variety of industrial training, will find the perfect solution in the MPS® PA Compact Workstation. Its minimal size provides:

- Industrial measurement, open- and closed-loop control
- 4 basic control loops
- Learning scenarios for automation (sensor technology, PLC, operation and monitoring) based on continuous processes
- Compact, state of the art industrial technology



**4 processes:  
Individual or in combination**

One control loop may perhaps be sufficient for basic teaching in measurement and control engineering for the chemical and water sectors. The stations of the MPS® PA provide a single control loop with learning content from all process engineering areas.

If a variety of typical control loops is important, simply combine the stations into a small-scale process engineering learning factory.



**Learning factories:  
Competences for hybrid production**

Production and process automation can rarely be separated in most industrial environments. Discrete and continuous production processes are merging.

The requirements of engineers at process control level, maintenance engineers and process designers are becoming increasingly complex. The hybrid learning factories from Festo Didactic provide the appropriate range of learning processes for specialist staff.

## EduKit PA

# The introduction to process engineering and closed-loop control



### Mobile and practical for beginners

The significance of closed-loop control is increasing constantly in all areas, since energy and resources can be saved using this technology. Moving towards efficient production, individual steps need to be planned, processes understood and verified. The EduKit PA modular projects provide a simple and safe introduction to process engineering and closed-loop control.



### MSR specialist in 2 stages

The EduKit PA Basic provides a step-by-step introduction to manual measurement and open- and closed-loop control, using the example of a simple system with level, flow and pressure control.

The EduKit PA Advanced adds the automation technology, with pressure, flow and ultrasound sensors and an I/O connecting board for a controller of your choice. A 2/2 way solenoid valve controls the filling into the lower tank. An industrial process valve can also be used here.



### The choice of controller is yours!

As everywhere, in the EduKit PA the SysLink interface guarantees problem-free connection to any type of controller:

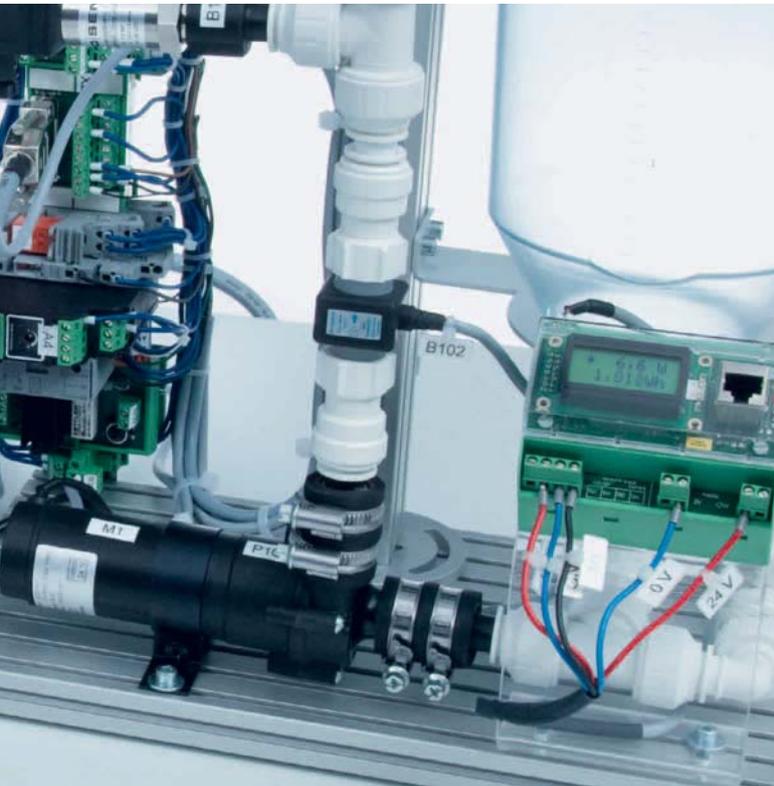
- The Sim-Box for initial familiarisation with the process and for commissioning
- FluidLab® PA process, the measuring and exercise software designed for the EduKit
- LabVIEW for designing measuring and control applications, with finished VIs
- An EduTrainer® Universal and any other PLC



### Ready to use

Unpack, set up and use. Setting up the first EduKit PA subsystem is part of putting together the project.

The modular concept (Basic and Advanced) meets the requirement of setting exercises for differentiated training. The EduKit PA provides appropriate projects for technical training in schools and for professional training.



**Learning environments with FluidLab® PA process**

With the EduKit PA, you benefit from industrial technology on the one hand and methodical software support on the other. FluidLab® PA process guides the student step by step, exercise by exercise through the world of measuring and control engineering. What is shown on the screen is actually happening in the actual system or simulation. FluidLab® PA process gives the students the feeling of being in the control station, thus contributing to a high level of motivation.

**The learning concept**

The learning concept of the EduKit PA supports experimental learning, as well as teaching supported by the teachware.

The experience of Festo engineers and the industrial experience of our trainers have been incorporated in many instances. It is therefore no surprise that EduKit PA is being used for advanced training of specialist staff in industry throughout the world.

**Hot topic: Energy efficiency**

In the chemical and pharmaceutical industry and in the food industry, we find state of the art technologies that help to prevent energy and resources being wasted. The EduKit PA includes scenarios in which hot topics such as energy efficiency and environmental protection can be illustrated.

2 supplementary sets provide the necessary equipment for further practical experiments:

- A DC Wattmeter for energy measurement
- A modern pinch valve for flow optimisation



**Energy monitoring with DC Wattmeter**

How can I save power? When should I save power? Which equipment eats up power? These questions are crucial to ensuring efficient management of energy – in the domestic sphere and in production.

Identifying potential savings first involves measuring current consumption. The DC Wattmeter is used as a smart meter for training systems.



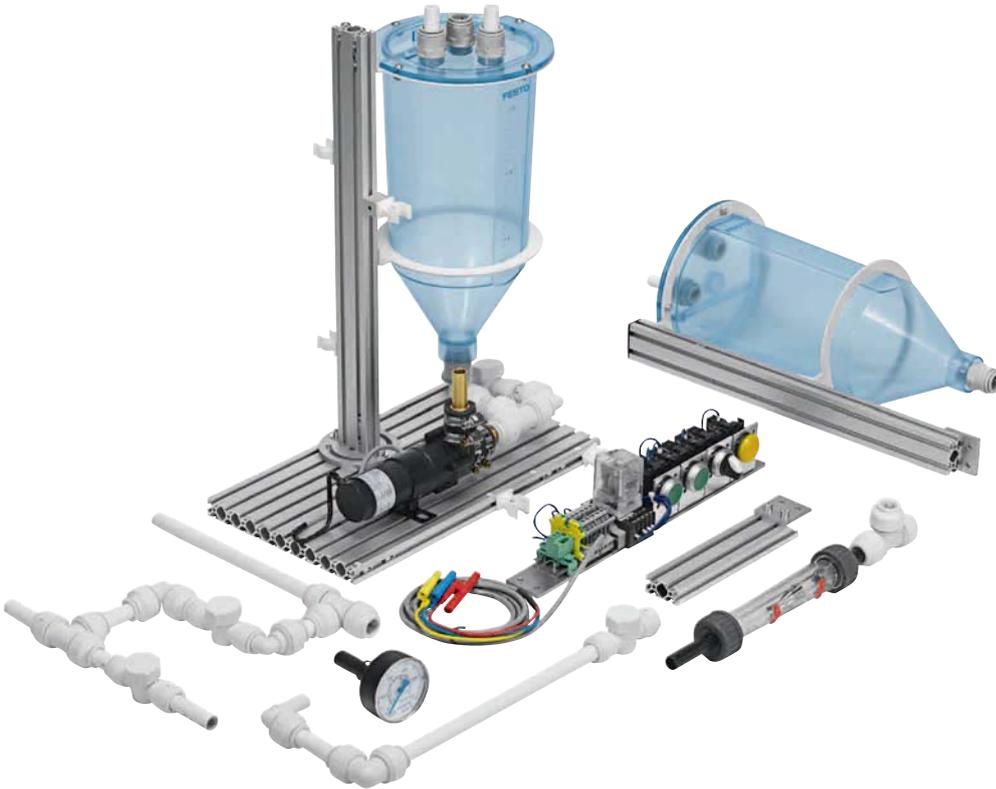
**High tech alternative: pinch valve**

An increasing number of valves and drives are operated pneumatically in process engineering. In many cases, this is safer, more economical and more energy efficient.

The new, highly elastic, pneumatically operated pinch valve seals the production flow gas tight with 2 to 3 bar differential pressure supply. Thanks to its rebound resilience it returns to the open position with no drive after venting, guaranteeing an almost friction-free flow of material.

# EduKit PA

## Unpack and away you go



### EduKit PA Basic

Teaches the basic principles of project work and the fundamentals of closed-loop control – manual measurement, open and closed-loop control – without a PC and without sophisticated control technology.

#### The benefits to you

- Handy, easy to transport and simple to set up
- Step by step construction of a functional system: start with a small setup – a tank – and finish the project with a level control system.
- Training documents available
- Easy to use and expandable for use with other topic areas
- Water acts as a non-hazardous teaching medium ideally suited for closed-loop control
- Consistent with existing Festo Didactic systems

#### Learning content for project work

##### Planning a project:

- Allocating tasks in teams
- Creating a project plan with different steps

##### Construction, assembly, connection:

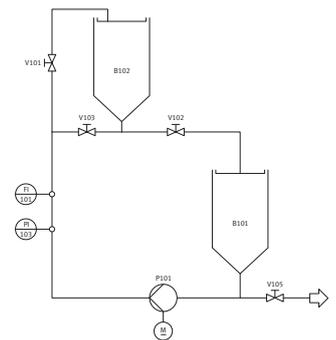
- Creating sketches for the pipe connection system
- Producing an assembly diagram
- Mechanical assembly
- Electrical connection of pump to 24 V supply
- Checking activities
- Creating test logs

##### Commissioning and measured data acquisition:

- System start-up
- Recording measured values with changed valve position, changed voltage on the pump or different fill heights
- Observation of level, pressure and flow, as well as time response

##### Presentation and documentation:

- Creating assembly instructions
- Documenting measured values
- Graphical analysis
- Presenting project process



As well as electrical pneumatic diagrams, you will also learn how to understand and describe a PI diagram.

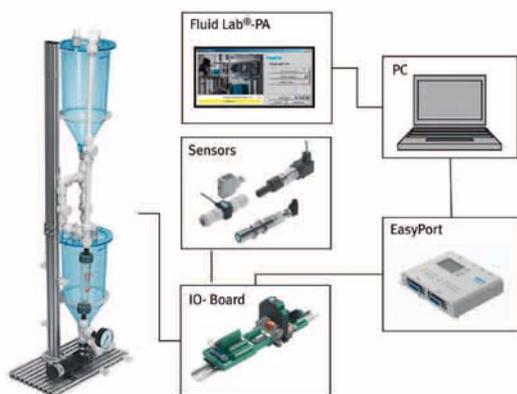
**EduKit PA Basic in the Systainer 549822**

The most important components at a glance:

1x Pump	170712
2x Tank, round	548596
1x Flow meter	548604

Accessories, also order:

Tabletop power supply unit → Page 235	
Pipe and tubing cutter	7658
Tool set	539767



Also order:

**Workbook**

with project tasks and solutions for EduKit PA Basic and Advanced on:

- Technological issues
- Mathematics
- Open-loop control
- Closed-loop control
- Work scheduling

Includes CD-ROM containing:

- Parts lists and data sheets
- RI flowcharts and circuit diagrams
- Assembly instructions for mechanical construction
- Checklists for commissioning
- Acceptance logs
- Worksheets for recording characteristic curves



Campus licence (→ Page 53):

de	563969
en	563971
es	563973
fr	563975

WBT Process automation → Page 26



**EduKit PA Advanced**

Supplements the EduKit PA Basic modular product system with the topics of automated measurement, open and closed-loop control, sensors and electrical interfaces. The EduKit PA Basic is required when using the components of the EduKit PA Advanced.

**EduKit PA Advanced in the Systainer 564631**

The most important components at a glance:

1x I/O board for EduKit PA	549823
2x Sensor, capacitive	549824
1x Sensor, ultrasound	548689
1x Flow sensor for EduKit PA incl. transducer	549825
1x Pressure sensor 0 – 400 mbar	549826
1x 2/2-way solenoid valve	549827

Recommended accessories for control:

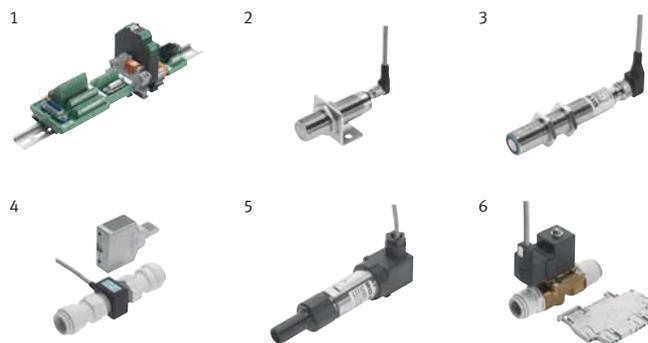
EasyPort USB	548687
FluidLab PA process: Getting started in process engineering → Page 417	
FluidLab-PA closed loop: Control engineering in focus → Page 417	
I/O data cable with SysLink connectors (IEEE 488), 2.5 m	34031
Analogue cable, parallel, 2 m	529141

The open interface provides various actuation options, e.g. controllers from Siemens, Festo, Allen Bradley and Mitsubishi.

Possibilities of expansion:

2-way ball valve for EduKit PA with quarter-turn actuator DAPS, double-acting	549828
Float switch sensor, top	548597

Additional components → Internet



# MPS® PA Compact Workstation

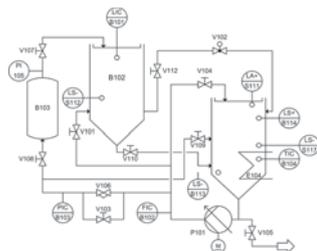
## Measurement, open and closed loop control in minimal space



### Optimum use of space

Do you have limited space or do you want high complexity from an individual training station?

If so, the MPS® PA Compact Workstation with 4 integrated control loops is the perfect solution.



### Core competence: The RI flowchart

As the flowchart shows, the individual control loops can be activated simply by adjusting the ball valves. The flexible piping system allows quick changes to the flow pattern or integration of additional components.



### Huge flexibility

Controllers and operating units are not permanently installed, but are simply clicked into place in the ER mounting frame. This enables the controller, operating unit or touch panel to be replaced in next to no time.



### Option: refrigeration engineering

The standard version of the MPS® PA Compact Workstation provides 4 control loops. In addition, a cooling unit with heat exchanger and a water/air cooler are available. This results in even more options for temperature control.



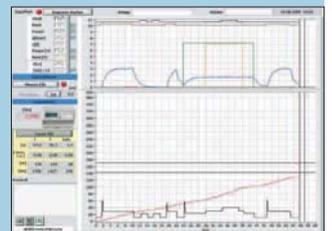
**Hot topic: energy efficiency**

As everywhere in automation, software plays an outstanding role in the Compact Workstation, e.g. in measuring technology. The process data can be clearly visualised using the measuring software and then analysed by either the whole class or as group work.

The exciting questions waiting to be answered:

- What process steps lead to unwanted increased energy consumption?
- How can consumption peaks be avoided?
- What does it achieve, what does it cost?
- Which investments or changes will achieve the greatest effects?

Training with the MPS® PA Compact Workstation becomes a multi-faceted, exciting and cross-subject project.



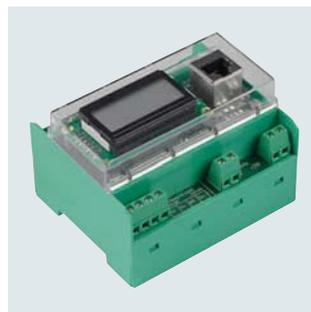
**Networked technologies**

An increasing number of valves with pneumatic drives are being used in water supply and disposal. This is safer and more energy efficient. Therefore, no modern learning system should be without a 2 way ball valve with pneumatic process drive and signal box. It represents the increasing integration of different technologies in process automation.



**Professional performance recording**

The Sentron PAC4200 multifunction measuring unit from Siemens records and saves measured values such as voltage, current and energy consumption, allowing analysis of the network quality. The unit can be incorporated into master control systems and energy management systems via Ethernet.



**On the trail of waste**

Identifying potential savings means first of all: measuring current consumption. The Wattmeter acts as a smart meter for training systems with a 24 V DC power supply and a maximum of 120 Watts. A switchable interface for 0 – 10 V DC or 4 – 20 mA is integrated for data transmission. Ethernet is available as an option.

# MPS® PA Compact Workstation

with level, flow rate, pressure and temperature controlled systems



## Function

The four controlled systems in the MPS® PA Compact Workstation can each be operated individually.

Using a corresponding controller, the level and flow rate controlled system can be set up as a cascade control system.

The design of the sensors and valve actuators allows the use of both continuous (e.g. P, I, PI, PID) and discontinuous controllers (e.g. two-point controllers) in testing. The pumps can be controlled using either direct actuation or speed adjustment.

With the flow rate and pressure controlled systems, the manipulated variable of the controller can also be used to operate a proportional directional control valve. A two-way ball valve with a pneumatic process actuator is installed in the return between the elevated tank and the lower reservoir. The two-way ball valve can be used to simulate a "load" for disturbance variable compensation in the level controlled system.

## Variants

The MPS® Compact Workstation is available in a number of different designs to suit the focus of your training.

The **Process Instrumentation** version is fitted with parameterisable sensors and includes a capacitive level sensor (two-rod probe), a magnetic-inductive flow meter with evaluation unit and HART interface and a configurable pressure and temperature sensor PT100.

The MPS® PA Compact Workstation **Energy** is equipped with current and power meters, and includes the measuring and training software FluidLab®-PA Energy.



MPS PA Compact Workstation Basic Design	C41001
MPS PA Compact Workstation Process Instrumentation	C41008
MPS PA Compact Workstation Energy	C41009

**MPS PA® Compact Workstation Basic Design**

Scope of delivery:

**Mechanical components:** 2 reservoirs, pressure reservoir, plug-in tube system, mounting frame, profile plate

**Sensors:** 2 capacitive sensors, 2 float switches, ultrasound sensor, flow sensor, pressure sensor, temperature sensor PT100

**Actuators:** pump, proportional directional control valve, ball valve with pneumatic process actuator, heating

**Electrical components:** I/O connection board with measuring transducer, motor controller, I/O terminal, SysLink, 8I/8O, analogue terminal, SysLink, 15-pin

**Media:** Technical documentation with workbook

**MPS PA® Compact Workstation Process Instrumentation**

Different scope of delivery to the basic design:

**Sensors:** capacitive level measurement, two-rod probe for continuous level measurement, magnetic-inductive flow meter with evaluation unit, on-site indicator and HART interface, pressure sensor, configurable with on-site indicator, temperature sensor PT100, configurable with on-site indicator, level vibration limit switch for fluids

**Electrical engineering:** signal conversion with parameterisable measured-value transducers, includes parameterisation software and programming cable

**Media:** Technical documentation with workbook

**MPS PA® Compact Workstation Energy**

Different scope of delivery to the basic design:

**Electrical engineering:** DC Wattmeter, power meter up to 5 A/24 V DC, incl. Ethernet interface, mounted on mounting bracket, AC multi-function meter PAC 4200 for measuring total output incl. Ethernet interface, built into 19" front panel

**Software:** FluidLab®-PA energy

**Media:** Technical documentation with workbook

Recommended accessories:

Power supply unit for mounting frame → Page 239	
Trolley	541139
Water-air cooler	C44000
Cooling unit with heat exchanger	C44001
FluidLab PA process: Getting started in process engineering → Page 417	

Recommended training media, also order:

MPS PA Compact Workstation Workbook, de	C46000
MPS PA Compact Workstation Workbook, en	C46001
Process automation: WBT → Page 26	
Open- and closed-loop control: WBT → Page 23	



**Control variants of the MPS® PA Compact Workstation**

**Control Kit S1:**

**Siemens SIMATIC S7-313C**

- 1x EduTrainer® Universal S7-313C
- 1x control unit
- 2x I/O data cable
- 1x analogue cable

Note:

STEP 7 software and MPI cable supplied separately.

**Control Kit S1-DP:**

**Siemens SIMATIC S7-314C-2PN/DP**

- 1x EduTrainer® Universal S7-314C-2PN/DP
- 1x control unit
- 2x I/O data cable
- 1x analogue cable

Note:

STEP 7 software and MPI cable supplied separately.

**Touch panel TP700:**

For expanding the control kit S1-DP. Touch panel TP700 built into console housing, with connecting cable and application for the compact workstation MPS® PA.

**Control kit PCS 7:**

- 1x SIMATIC Hardware Trainer Package PCS 7 AS-RTX and ET200M
- 1x EduTrainer® Universal for PCS 7 AS-RTX
- 1x EduTrainer® Universal for ET200M with 16DI/16DO/8AI/4AO
- 1x SIMATIC Software Trainer Package PCS 7 V8.0, 3 licences
- 1x PC with Windows 7 Ultimate, pre-installed as engineering station PCS 7 V8.0
- 1x PCS 7 process control engineering example application

**Control Kit PC2:**

**FluidLab®-PA with EasyPort**

- 1x FluidLab®-PA closed-loop single licence
- 1x EasyPort
- 1x I/O data cable
- 1x analogue cable

**Control Kit F1:**

**Festo CPX-CEC**

- 1x Festo CPX-CEC Codesys®
- 1x control unit
- 1x Ethernet cable, crossed
- 2x I/O data cable
- 1x analogue cable

Note:

Codesys® programming software included in the scope of delivery.

**Touch Panel FED:**

For expanding the Control Kit F1. Touch Panel FED built into console housing, with connecting cable and application for MPS® PA Compact Workstation.

**Control Kit SimBox:**

- 1x simulation box incl. 24 V DC cable
- 1x I/O data cable, crossed
- 1x analogue cable, crossed

Siemens SIMATIC S7-313C

Order no. **C43001**

Siemens SIMATIC S7-314C-2PN/DP

Order no. **C43014**

Touch Panel TP700

Order no. **C43019**

PCS 7

Order no. **C43020**

FluidLab-PA + EasyPort

Order no. **C43005**

Festo CPX-CEC

Order no. **C43007**

Touch Panel FED

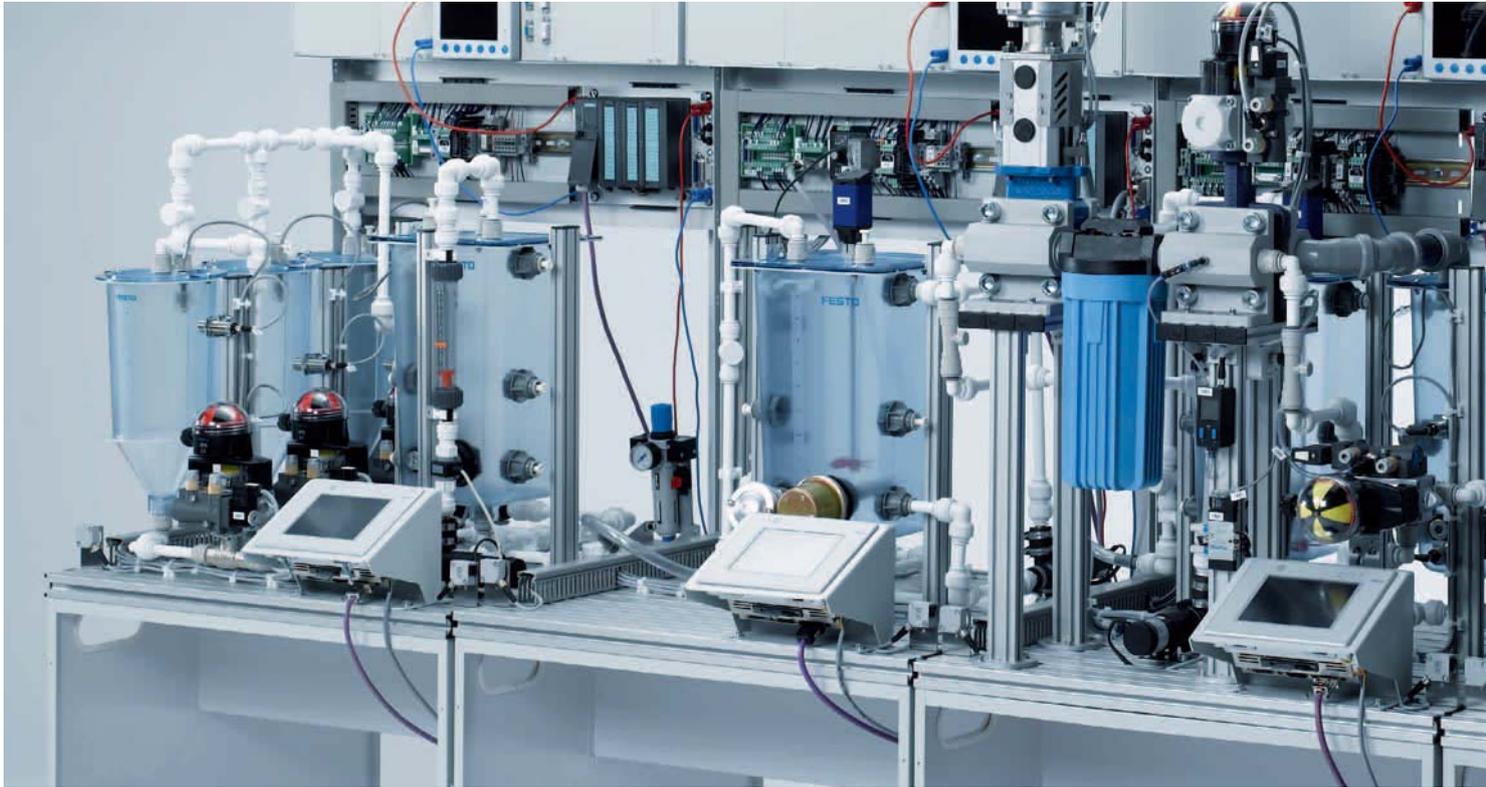
Order no. **C43010**

SimBox

Order no. **C43016**

# MPS® PA stations and complete systems

## The elementary control loops in the process industry



### Unlimited possibilities thanks to open interface concept

The new interface concept opens up a wide range of options for directly combining the individual MPS® PA stations.

Deciding on one combination or another depends on various factors:

- Training content
- Supplementing existing stations
- Your budget
- Completely configured MPS® PA 204 system



### Filtering station

Aquarium, vacuum cleaner, atomiser, sewage plant, waterworks – filters are of critical importance in many areas and the key question is: how can I ensure a constant flow with any level of filter contamination? And how can the filter be cleaned more effectively? Perhaps using compressed air?

These questions are covered in the learning objectives for the filtration station. Towards the end of the training it becomes clear which open and closed loop control principles provide the right solution and which are the right technologies.



### Mixing station

Food and confectionery, paints, construction materials, pharmaceutical products – the correct proportions of different materials are crucial to the quality of the end product. Constant metering and mixing of the components makes high demands on the controller and the equipment involved in the process.

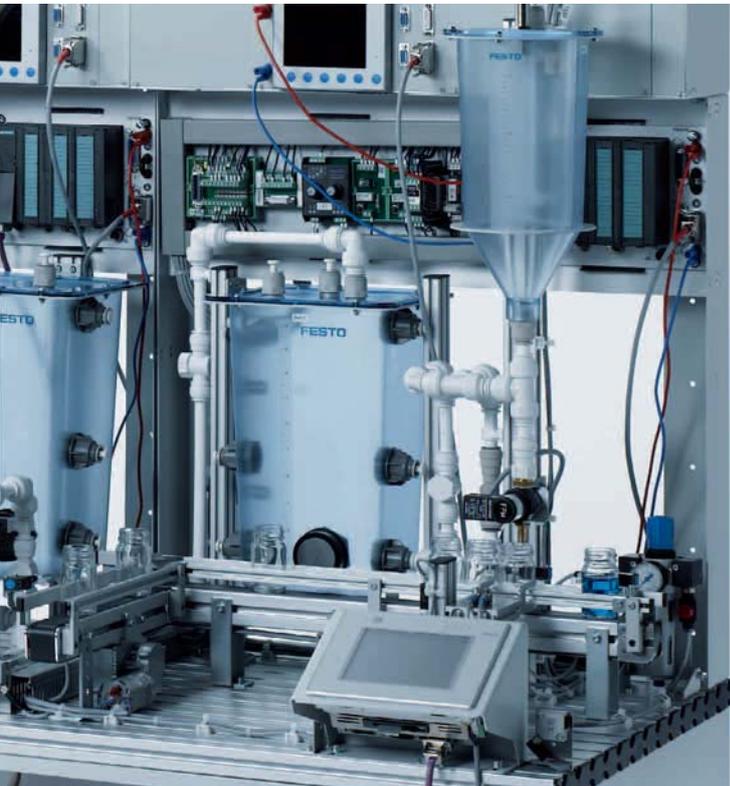
The mixing station provides state of the art equipment, control components, controllers and operator control elements for demanding, motivating projects on one of the most common control loops in process automation – flow control.



### Reactor station

To extend the shelf life of foods, improve the mixing capacity of liquids or allow them to be mixed, there are a large number of optimised heating processes in the chemical industry.

Temperature control makes extraordinary demands on the electronics and the components used as handling head is not without its problems. The reactor station demonstrates its realism in conjunction with the operation and monitoring software.



**Continuous and discrete:  
MPS® PA across boundaries**

Each of the MPS® PA stations represents a closed process, such as can be found in an identical or similar form in many industry sectors. Their control loops provide content for designing demanding courses in measuring and control engineering. They represent the most important continuous processes.

It is only in conjunction with the mechatronic MPS® stations that you can start to see what we mean by “system”:

All stations can be combined with one another. The MPS® PA stations can be linked to the mechatronic MPS® stations and the discrete processes they represent with no problems at all. The SysLink interface is the basis for this.

This means that you can move into the industrial reality of hybrid production with minimal investment.

From an individual MPS® PA station to an AFB factory, MPS® does not set any limits.

**All four in one**

Anyone who wants to use all 4 stations in a network should order them as a complete PA 204 MPS® system. The advantage: we commission and test the system. All you have to do is supply fresh water.

If you want to combine on site commissioning with instruction for the responsible trainers, you can take advantage of our MPS® PA commissioning service.



**Bottling station**

Customers get annoyed if there is less in a drinks bottle than it says on the label. For drinks producers, a consistent and guaranteed fill quantity is a crucial quality feature.

The bottling station represents a realistic industrial environment, in which all aspects of a quality optimised filling process can be learned and experienced. The projects focus on level monitoring and positioning of the containers to be filled.



**Standard with EduTrainer® and FED 550**

All of the MPS® PA stations are supplied fully assembled. You can provide the controller yourself or order the EduTrainer® of your choice at the same time. You should order the new EduTrainer® Universal as a rack version with feet. Use one of our preferred versions or configure your EduTrainer® yourself.

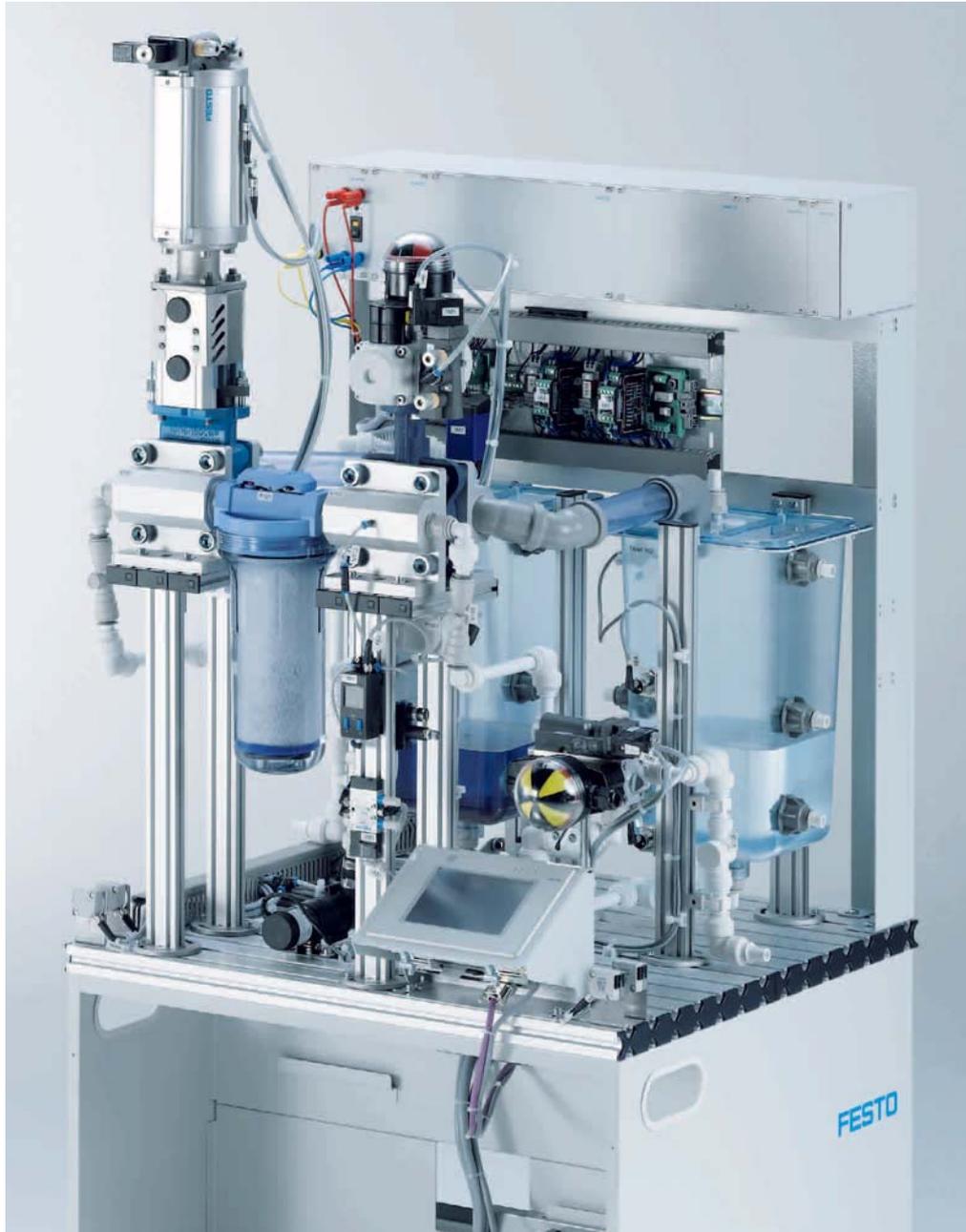


**CODESYS® integrated in FED-CEC**

The trend towards integrating multiple control components into a single device is reflected in the new FED-CEC. The new control panel from Festo contains a PLC for programming with Codesys® in compliance with IEC 61131.

The FED-CEC provides an Ethernet interface and – typically for Festo – an integrated CANopen master interface for easy actuation of the valve terminals on the MPS® PA stations and, of course, a SysLink and analogue interface with FED-UIM.

# Filtration station



## Function

The Filtration station filters liquids. The filtrate is pumped from the first tank into the second tank through the filter using a knife gate valve. The filtered liquid reaches the second tank via the flap with pneumatic semi-rotary drive. The filtered liquid can be pumped onwards to the next station using a separate pump. The filter can be rinsed using a rinse program. Regulated compressed air is additionally blown through the filter to loosen deposits.

## Measurement and control

Sensors detect the filling level of the container in the Filtering station. This permits lessons on simple control exercises for monitoring the pumps right up to complete control projects involving complex processes.

Pressure control ensures constantly high filter quality during flushing. The pressure sensor with LCD display, analogue output and switching output always supplies the correct measurement variable. The controller with P, PI or PID control algorithm ensures constantly high filter quality during rinsing via the proportional pressure regulator. Control technology is clearly and practically explained in this way.

## Shutting off, opening, closing

The right selection of process valve, drive, drive accessories and control valve plays an important role in complex process sequences. The Filtering station uses an extremely wide range of process components. All the valve actuators are actuated via a directly connected NAMUR valve.

**Knife gate valve** with COPAC linear actuator.

**Butterfly valve** with sturdy rack and pinion COPAR rotary actuator and large visual display.

**Three-way ball valve** with SYPAR scotch yoke rotary actuator and large visual display.



<b>Filtration station</b>	<b>544253</b>
(with trolley, colour touch panel, mounting frame and power supply unit)	

Also order:

Open-loop and closed-loop control with PLC:

EduTrainer Universal A4 rack with SIMATIC S7-313C	567098
SIMATIC S7 connecting cable set	544296
EduTrainer Universal A4 rack with Festo CPX-CEC analogue	567275
Festo CPX connecting cable set	544297
EduTrainer Universal A4 rack with Allen Bradley ML 1500 analogue	567102
Allen Bradley MicroLogix connecting cable set	544298
EduTrainer Universal A4 rack with Mitsubishi MELSEC FX1N analogue	567101
Mitsubishi MELSEC connecting cable set	544299
Safety laboratory cable, 3 m	571817
I/O data cable with SysLink connectors (IEEE 488) at both ends, 2.5 m	34031

Or alternative:

SIMATIC S7 EduTrainer Compact 313C	533018
SIMATIC S7 connecting cable set	544296

For working with FluidLab®-PA closed loop:

FluidLab-PA closed loop → Page 417	
EasyPort USB	548687
I/O data cable with SysLink connectors (IEEE 488) at both ends, 2.5 m	34031
Analogue cable, parallel, 2 m	529141

For simple commissioning, simulation and display using the simulation box:

Simulation box, digital/analogue	526863
I/O data cable with SysLink connectors (IEEE 488) on both ends, crossover	167106
Analogue cable, crossover, 2 m	533039

Recommended accessories:

Replacement filter cartridge	544303
IEC power cable → Page 239	

Additional components → Internet

**Training aims for project work**

- Set-up, wiring and commissioning of a system for process technology
- Selection, application and actuation of process valves
- Measurement of electrical and process-related variables such as level and pressure
- Set-up and commissioning of control circuits
- Analysis of control processes and control circuits
- Parameterisation and optimisation of P, PI or PID controllers
- Drafting of open-loop and closed-loop control programs
- Process operation and monitoring
- Inspection, maintenance and servicing

Also order:

**MPS® PA workbook**



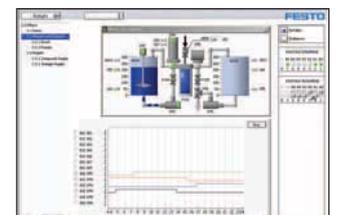
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WBT Process automation → Page 26



FluidLab®-PA → Page 417



**Recommended training media**

- Design and simulation program FluidSIM® Pneumatics
- WBT Open- and closed-loop control

# Mixing station



## Function

The mixing station mixes different recipes from three reservoir tanks. The liquid from one of the three reservoir tanks is pumped into the main tank in a controlled manner by opening the respective two-way ball valve. The finished mixture can be pumped to the next station via a second pump – or pumped back to the reservoir tank.

## Measurement and control

Using a constant flow rate, the three raw materials are mixed to a recipe in the mixing station. The flow rate is recorded by means of an electronic flow sensor with impeller and additionally displayed using a variable-area flowmeter. The output signal from the flow sensor is converted to a standard signal from 0 – 10 V. The mixing station can also be actuated through binary means using the integrated comparator. The controller adjusts the necessary flow rate via the pump with analogue control – using a simple two-point controller or various dynamic controllers such as P, PI or PID. This permits a clear explanation of control technology on various levels.

## Always the right mixture

The component mix of the mixing station offers a wide selection of typical components from process engineering. Pumps and process valves, various sensors for signal detection as well as electronic modules for signal conversion permit the right ‘training mix’.

**Sensors** for detecting the filling level of containers. With overflow protection thanks to additional sensors on each container, thereby virtually eliminating the possibility of overflow.

**Signal converters** convert all analogue signals from the station to standard signals from 0 – 10 V. Practical for the purpose of experimentation: integrated comparators also supply purely binary signals.

**Two-way ball valve** with SYPAR scotch yoke rotary actuator, large optical display and directly connected NAMUR valve.



Mixing station	544254
(with trolley, colour touch panel, mounting frame and power supply unit)	

Also order:

Open-loop and closed-loop control with PLC:

EduTrainer Universal A4 rack with SIMATIC S7-313C	567098
SIMATIC S7 connecting cable set	544296
EduTrainer Universal A4 rack with Festo CPX-CEC analogue	567275
Festo CPX connecting cable set	544297
EduTrainer Universal A4 rack with Allen Bradley ML 1500 analogue	567102
Allen Bradley MicroLogix connecting cable set	544298
EduTrainer Universal A4 rack with Mitsubishi MELSEC FX1N analogue	567101
Mitsubishi MELSEC connecting cable set	544299
Safety laboratory cable, 3 m	571817
I/O data cable with SysLink connectors (IEEE 488) at both ends, 2.5 m	34031

Or alternative:

SIMATIC S7 EduTrainer Compact 313C	533018
SIMATIC S7 connecting cable set	544296

For working with FluidLab®-PA closed loop:

FluidLab-PA closed loop → Page 417	
EasyPort USB	548687
I/O data cable with SysLink connectors (IEEE 488) at both ends, 2.5 m	34031
Analogue cable, parallel, 2 m	529141

For simple commissioning, simulation and display using the simulation box:

Simulation box, digital/analogue	526863
I/O data cable with SysLink connectors (IEEE 488) on both ends, crossover	167106
Analogue cable, crossover, 2 m	533039

Recommended accessories:

IEC power cable → Page 239	
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Additional components → Internet

**Training aims for project work**

- Construction, wiring and commissioning of a system for process technology
- Selection, application and connection of various flow sensors
- Measurement of electrical and process-related variables such as level and flow rate
- Design and commissioning of control circuits
- Analysis of control processes and control circuits
- Parameterisation and optimisation of P, PI or PID controllers
- Drafting of open-loop and closed-loop control programs
- Process operation and monitoring
- Inspection, maintenance and servicing

Also order:

**MPS® PA workbook**



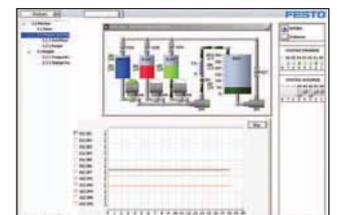
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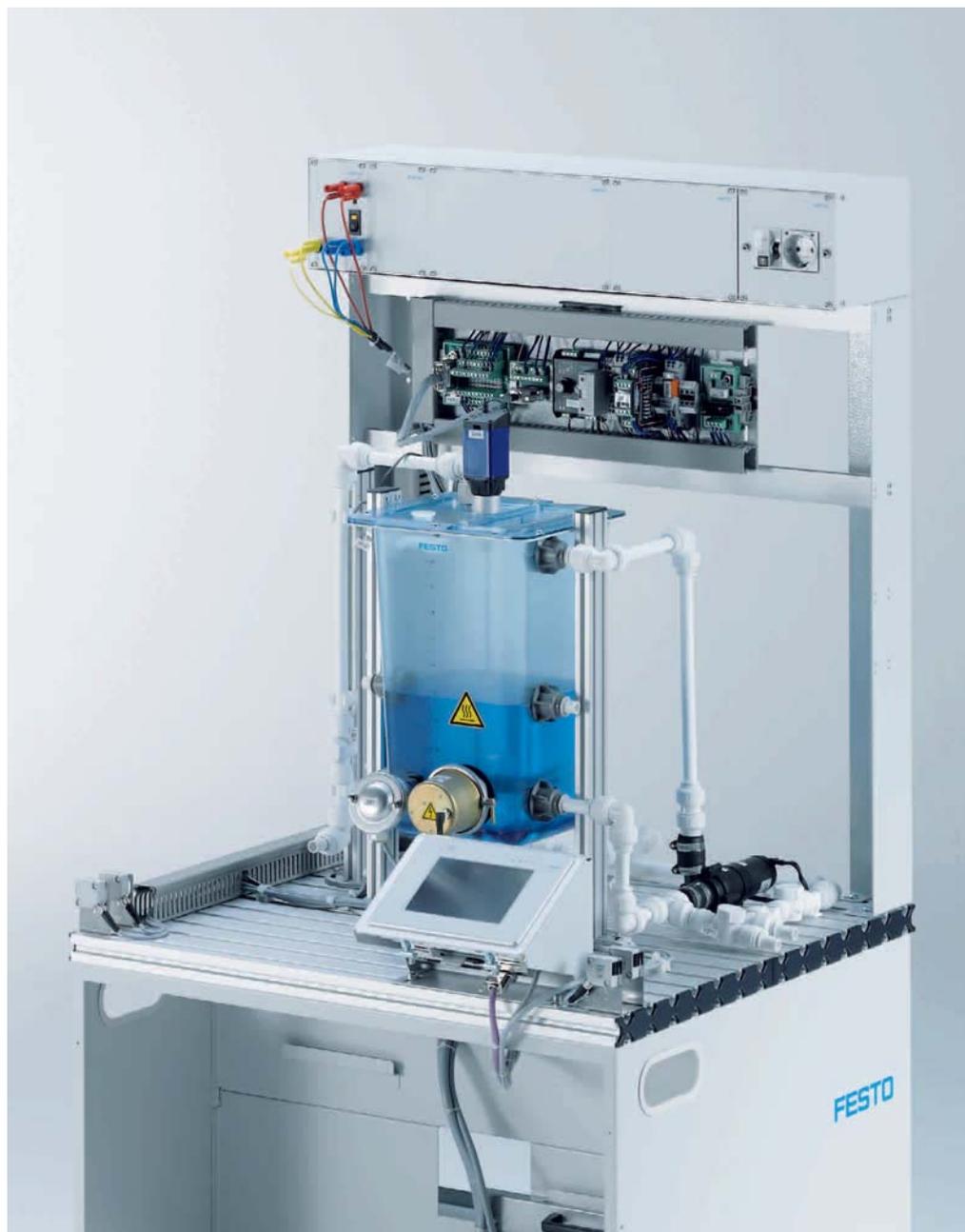
FluidLab®-PA → Page 417



**Recommended training media**

- Design and simulation program FluidSIM® Pneumatics
- WBT Open- and closed-loop control

# Reactor station



## Function

The reactor station brings liquid to the right temperature. Depending on the recipe selected, different temperature profiles with different stirring times are activated. A cooling pump is activated to cool the liquid. The tempered liquid can be pumped onwards to the next station using a separate pump.

## Measurement and control

Sensors detect the filling level of the reservoir in the reactor station. This facilitates lessons on simple control exercises for monitoring the pumps right up to complete control projects involving complex processes.

Exact adherence to the various temperature profiles when activating the recipes is achieved by means of temperature control. The temperature sensor (PT100 resistance thermometer) supplies a unit signal of 0 – 10 V via the measuring transducer. The controller with P, PI or PID control algorithm can approach the set-point temperature values via the dynamically controlled heating unit and keep the values constant. Simple control exercises, for example control using the two-point controller, can be realised using the reactor station. Control technology is clearly and practically explained in this way.

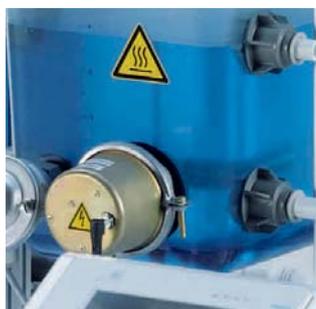
## Heating and stirring

Key basic operations in many process engineering systems involve heating and stirring. The components of the reactor station are designed to permit a wide range of experiments in this area.

Infinitely adjustable **heating** with control signal from 0 – 10 V. A safe experimental environment permits integrated linking of the heater with the integrated temperature switch – thus ruling out the possibility of “running dry” in a practical way.

## Stirrer with DC motor

**Signal converters** convert all analogue signals from the station to standard signals from 0 – 10 V. Practical for the purpose of experimentation: integrated comparators also supply purely binary signals.



<b>Reactor station</b>	<b>544255</b>
(with trolley, colour touch panel, mounting frame and power supply unit)	

Also order:

Open-loop and closed-loop control with PLC:

EduTrainer Universal A4 rack with SIMATIC S7-313C	567098
SIMATIC S7 connecting cable set	544296
EduTrainer Universal A4 rack with Festo CPX-CEC analogue	567275
Festo CPX connecting cable set	544297
EduTrainer Universal A4 rack with Allen Bradley ML 1500 analogue	567102
Allen Bradley MicroLogix connecting cable set	544298
EduTrainer Universal A4 rack with Mitsubishi MELSEC FX1N analogue	567101
Mitsubishi MELSEC connecting cable set	544299
Safety laboratory cable, 3 m	571817
I/O data cable with SysLink connectors (IEEE 488) at both ends, 2.5 m	34031

Or alternative:

SIMATIC S7 EduTrainer Compact 313C	533018
SIMATIC S7 connecting cable set	544296

For working with FluidLab®-PA closed loop:

FluidLab-PA closed loop → Page 417	
EasyPort USB	548687
I/O data cable with SysLink connectors (IEEE 488) at both ends, 2.5 m	34031
Analogue cable, parallel, 2 m	529141

For simple commissioning, simulation and display using the simulation box:

Simulation box, digital/analogue	526863
I/O data cable with SysLink connectors (IEEE 488) on both ends, crossover	167106
Analogue cable, crossover, 2 m	533039

Recommended accessories:

Water-air cooler	C44000
Cooling unit with heat exchanger	C44001
IEC power cable → Page 239	

Additional components → Internet

**Training aims for project work**

- Construction, wiring and commissioning of a system for process technology
- Selection, application and connection of temperature sensors
- Measurement of electrical and process-related variables such as level and temperature
- Use and connection of measuring transducers
- Design and commissioning of control circuits
- Analysis of control processes and control circuits
- Parameterisation and optimisation of P, PI or PID controllers
- Drafting of open-loop and closed-loop control programs
- Process operation and monitoring
- Inspection, maintenance and servicing

Also order:

**MPS® PA workbook**



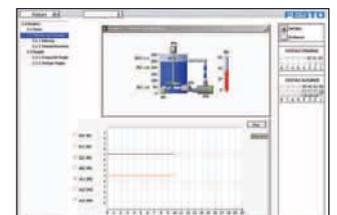
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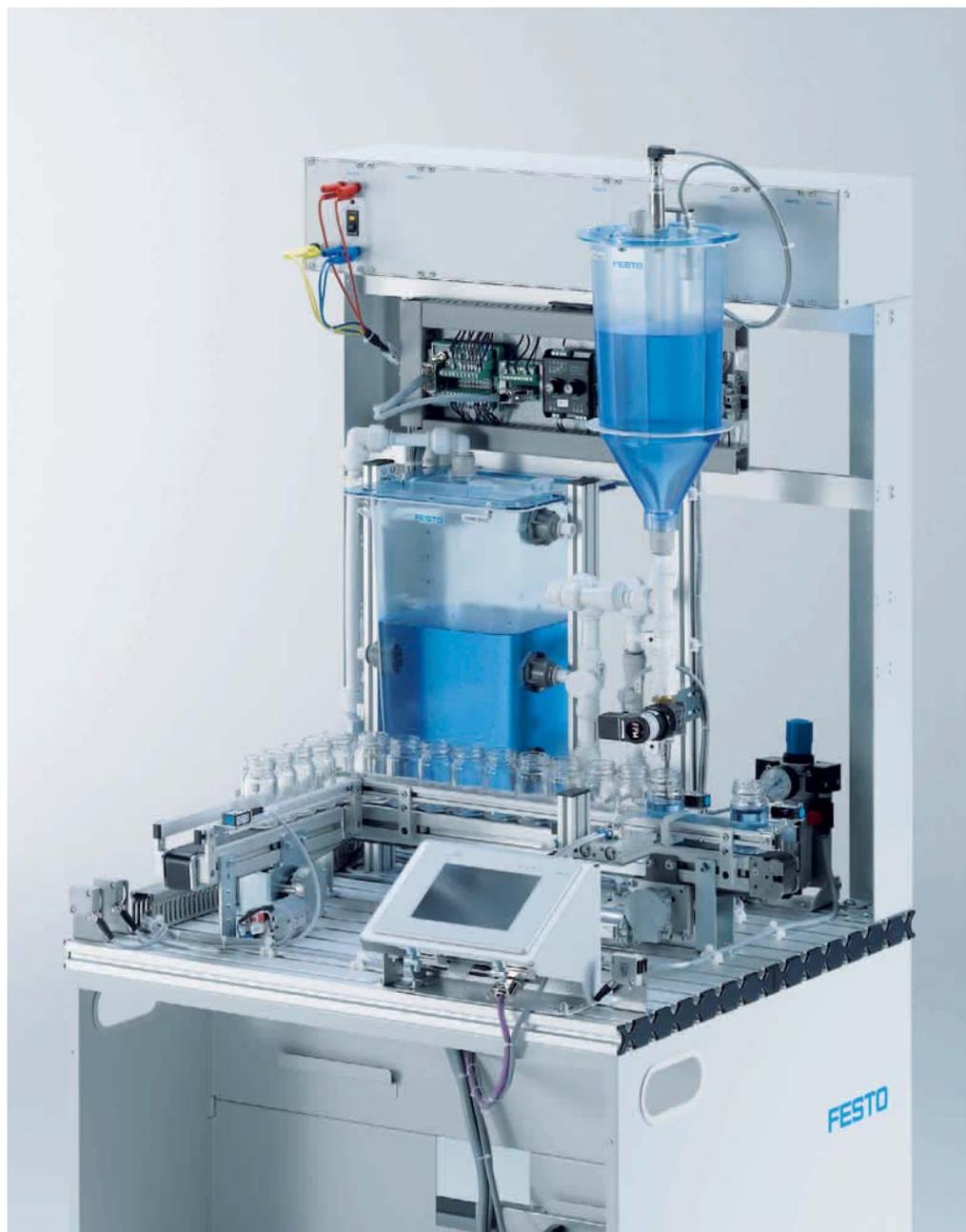
FluidLab®-PA → Page 417



**Recommended training media**

WBT Open- and closed-loop control

# Bottling station



## Function

The bottling station fills bottles with liquid. The liquid is pumped into the dosing tank from the reservoir. These bottles are transported to the filling position via conveyors. A pneumatic separator separates the bottles. The bottles are filled with different filling quantities from the dosing tank in accordance with the recipe selected.

## Measurement and control

The filling level of the dosing tank is detected in the filling station using an analogue filling level sensor. The controller regulates the filling level to the required setpoint value via the dynamically controlled pump (0 – 10 V).

The filling level in the dosing tank is kept constant during filling, which optimises the quality of the filling process. Various control algorithms such as P, PI or PID can be applied and optimised during experiments. The characteristics of the control process can be modified using hand valves already integrated. Control technology is clearly and practically explained in this way.

## Transporting, separating, filling

Few segments of the diversified process industry are associated with such a wide range of end products as the food industry. All foodstuffs, whether dairy products, baked goods, juice, beer or wine have their own requirements with regard to the handling and production of the corresponding end products. Transporting, separating, proportioning and filling play an important role here.

**Optical sensors**, adjustable using background suppression, monitor transportation on the conveyors of the bottling station.

**The pneumatic separator** ensures that there is never more than one bottle at the filling position.

**The filling quantity** can be easily adjusted by selecting different recipes.



<b>Bottling station</b>	<b>544256</b>
(with trolley, colour touch panel, mounting frame and power supply unit)	

Also order:

Open-loop and closed-loop control with PLC:

EduTrainer Universal A4 rack with SIMATIC S7-313C	567098
SIMATIC S7 connecting cable set	544296
EduTrainer Universal A4 rack with Festo CPX-CEC analogue	567275
Festo CPX connecting cable set	544297
EduTrainer Universal A4 rack with Allen Bradley ML 1500 analogue	567102
Allen Bradley MicroLogix connecting cable set	544298
EduTrainer Universal A4 rack with Mitsubishi MELSEC FX1N analogue	567101
Mitsubishi MELSEC connecting cable set	544299
Safety laboratory cable, 3 m	571817
I/O data cable with SysLink connectors (IEEE 488) at both ends, 2.5 m	34031

Or alternative:

SIMATIC S7 EduTrainer Compact 313C	533018
SIMATIC S7 connecting cable set	544296

For working with FluidLab®-PA closed loop:

FluidLab-PA closed loop → Page 417	
EasyPort USB	548687
I/O data cable with SysLink connectors (IEEE 488) at both ends, 2.5 m	34031
Analogue cable, parallel, 2 m	529141

For simple commissioning, simulation and display using the simulation box:

Simulation box, digital/analogue	526863
I/O data cable with SysLink connectors (IEEE 488) on both ends, crossover	167106
Analogue cable, crossover, 2 m	533039

Recommended accessories:

Bottle set	567202
IEC power cable → Page 239	

Additional components → Internet

**Training aims for project work**

- Construction, wiring and commissioning of a system for process technology
- Selection and application of filling level sensors
- Measurement of electrical and process-related variables such as level
- Design and commissioning of control circuits
- Analysis of control processes and control circuits
- Parameterisation and optimisation of P, PI or PID controllers
- Drafting of open-loop and closed-loop control programs
- Process operation and monitoring
- Inspection, maintenance and servicing

Also order:

**MPS® PA workbook**



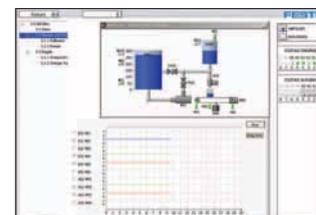
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**Recommended training media**

- Design and simulation program FluidSIM® Pneumatics
- WBT Open- and closed-loop control

## MPS® PA 204 Complete system



With a P, PI or PID control algorithm, (closed-loop) control technology is taught in a demonstrative and practical manner. The **temperature** sensor – for the Reactor station a PT100 resistance thermometer is used – delivers a uniform signal of 0 – 10 V via the measuring transducer. By way of the continuously controllable heater the controller sets the nominal temperatures and keeps them constant.



At a constant **flow rate**, the three input materials are mixed into a recipe on the Mixing station. The flow rate is recorded by an electronic flow sensor with an impeller, and is additionally displayed with a float-type flow meter. The controller sets the required flow rate by way of the analogue controlled pump.



The **pressure regulation** ensures a constant high filtering quality by means of back-flushing. The pressure sensor features an LCD display, analogue output and switching output, always delivering the correct value. A constant high quality is maintained by means of the proportional-pressure regulator.



In the Filling station the **level** of the dosing tank is recorded with an analogue level sensor. By way of the continuously controllable pump the controller regulates the level to the appropriate nominal value. During filling, the level in the dosing tank is kept constant, thereby optimising the filling quality.

MPS PA 204 SIMATIC S7-300	544248
MPS PA 204 Festo CPX-CEC	544249
MPS PA 204 Allen Bradley ML 1500	544250
MPS PA 204 Mitsubishi MELSEC FX1N	544251

**PLC control packages include:**

**SIMATIC S7-300**

4x EduTrainer® Universal with SIMATIC S7-313C, 1x programming cable, 1x STEP 7 Professional for Training programming software, 4x SIMATIC S7 connecting cable set

**Festo CPX-CEC**

4x Festo CPX-CEC EduTrainer® Universal, 1x programming cable, 1x programming software CoDeSys provided by Festo, 4x Festo CPX connecting cable set

**Allen Bradley ML 1500**

4x Allen Bradley EduTrainer® Universal with Micro Logix 1500, 1x programming cable, 1x RS-Logix 500 Starter programming software, 4x Allen Bradley connecting cable set

**Mitsubishi MELSEC**

4x EduTrainer® Universal with FX1N, 1x programming cable, 1x GX IEC Developer FX Trainer Package programming software, 4x Mitsubishi connecting cable set

**The MPS® PA 204 system contains everything you need for training:**

**Stations:** Filtering, mixing, reactor, filling (with trolley), colour touch panel, mounting frame and power supply unit

**Accessories:** 4x Simulation box digital/analogue, 1x bottle set

**Control technology:** 1x PLC control package, 1x EMERGENCY-STOP board, 2x EMERGENCY-STOP control panel, 4x EasyPort

**Software:** 4x FluidLab®-PA closed loop

**Function**

The system consists of the Filtering, Mixing, Reactor and Filling stations. The Filtering station filters a fluid. The filtrate is pumped out of the first tank via different process valves through the filter into the second tank. The filtered fluid is added to the first tank in the Mixing station. The Mixing station mixes different recipes from three storage tanks. The finished mixture is pumped to the Reactor station. The Reactor station regulates the temperature of the fluid. Different temperature profiles, with different mixing times, are run depending on the selected recipe. The Filling station bottles the fluid. The bottles are carried on conveyor belts to the filling position. A pneumatic separator marshals the bottles. The bottles are filled with different quantities from the dosing tank, depending on the selected recipe.

**Special training aims**

- Set-up, wiring and commissioning of a system for process technology
- Measurement of electrical and process engineering variables such as level, flow rate, pressure and temperature
- Set-up and commissioning of control circuits
- Assessment of control response
- Networking of process engineering systems
- Process operation and monitoring, system management
- Selection, deployment and control of process fittings
- Analysis of controlled systems and control circuits
- Parameter setting and optimisation of P, PI or PID controllers
- Writing open-loop and closed-loop control programs
- Process operation and monitoring
- Inspection, maintenance and servicing



**Included in the scope of delivery: Various facilities for measuring, controlling and regulating**

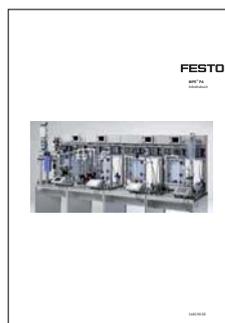
- Simplifies commissioning, simulation and display using the simulation box
- Multimedia measuring, controlling, regulating, operating, monitoring and commissioning using FluidLab® PA.
- Start processes in the PLC or monitor them with the touch panel
- The control task can be handled by the PLC or by the industrial controller also provided for each station. The controller parameters are then set on the touch panel or directly on the industrial controller. All process variables are displayed in a user-friendly way – including trend graphs – both on the touch panel and on the industrial controller.

The MPS® PA complete system provides everything needed for an efficient start in measurement and control technology.

**Successful project work based on modular construction**

Learning by doing – the MPS® PA system offers accessible, hands-on process technology. Some project ideas can be implemented in a flash, and risk-free.

Also order:  
MPS® PA **workbook**



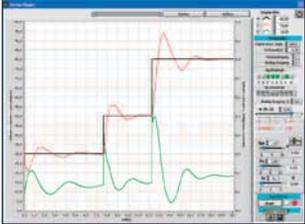
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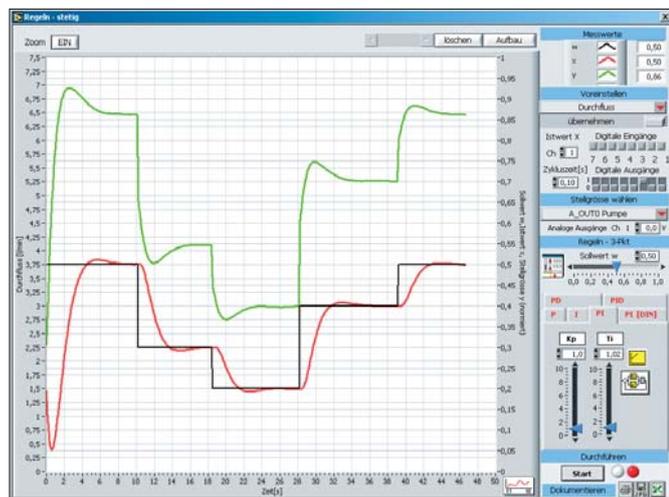


# Measuring and controlling as in industry

<p><b>The closest thing to reality</b>                      The MPS® PA learning system is based on industrial standards. The MPS® PA concept is based on a market leaders' automation solutions and trends.</p>	<p><b>Components</b></p>	<p><b>Operation and configuration</b></p>	<p><b>Advantages</b></p>
<p><b>SimuBox</b></p>			<ul style="list-style-type: none"> <li>– Simple commissioning of an MPS® PA station</li> <li>– Testing and commissioning of process components or system components of a station</li> </ul>
<p><b>FluidLab®-PA closed loop</b>                      or  <b>FluidLab®-PA process</b></p>			<ul style="list-style-type: none"> <li>– Commissioning and testing of an MPS® PA station</li> <li>– Analysis of process components and control processes of an MPS® PA station</li> <li>– Monitoring and analysis of the process sequences of a station</li> <li>– Testing, configuration and optimisation of control processes (2-point, P, PI or PID controllers)</li> <li>– Analysis of the control response</li> </ul>
<p><b>PLC</b></p>			<ul style="list-style-type: none"> <li>– Programming of process sequences and recipe controllers</li> <li>– Analogue signal processing</li> <li>– Operation and monitoring using the touch panel</li> <li>– Programming of PID controllers</li> <li>– Configuration and parameterisation of P, PI or PID controllers</li> </ul>
<p><b>PLC with external industrial controller</b></p>			<p>Same as PLC, plus:</p> <ul style="list-style-type: none"> <li>– Operation of an industrial controller (manual operation, automatic operation)</li> <li>– Parameterisation of industrial controllers (P, PI or PID control algorithm)</li> <li>– Configuration of measuring ranges, setpoint value limits and alarm limits</li> <li>– Self-optimisation with oscillation or step response method</li> </ul>

# FluidLab®-PA closed loop

## Control engineering in focus



Using FluidLab®-PA step by step to teach and demonstrate the fundamentals of control technology. The EasyPort is used to connect the PC and real hardware, e.g. the EduKit PA, the MPS® PA compact workstation or the MPS® PA filtration station, mixing, reactor, filling.

### Settings

Parametrisation of sensor values with factor and offset to represent the physical quantities as well as signal attenuation per median filter for the analogue input signals. Display of the physical value in the variable units field. Other possible settings are the inversion of the controller direction, Y offset in the continuous rules and the selection of the simulation mode.

### Menu: Measurement

All binary and analogue process data, for example the signal statuses of the sensors, process fittings and pump, can be displayed graphically and evaluated directly. To record the sensor characteristic and determining a step response, functions are available such as selection of measuring channels, adjusting the test time or cursor evaluation with zoom function.

### Menu: Characteristic curve

The characteristics of a final control element (e.g. pump or proportional valve) is investigated in various perspectives (voltage for flow, flow for pressure, pressure for voltage).

### Menu: 2-point controller

Typical applications are level and temperature controlled systems.

### Menu: Continuous regulation

Experimentation, configuration and optimisation of the control processes (P, PI, PD or PID controller) with immediate effect in the process. Controlled systems can be operated via mouse click. Trouble-free documentation of the control parameter is possible. The measured values and curve profiles can be documented comprehensively. The **block diagram** can be displayed as a function menu for all continuous controllers with current numerical values.

### Industrial controller functions

System operation like in a process control system. It is possible to specify nominal values, display warning limits and switch the controller between manual and automatic.

### Simulation

A simulated process model illustrates the sequence identically to the operation of the real hardware.

FluidLab®-PA for **MPS® PA stations** is included.

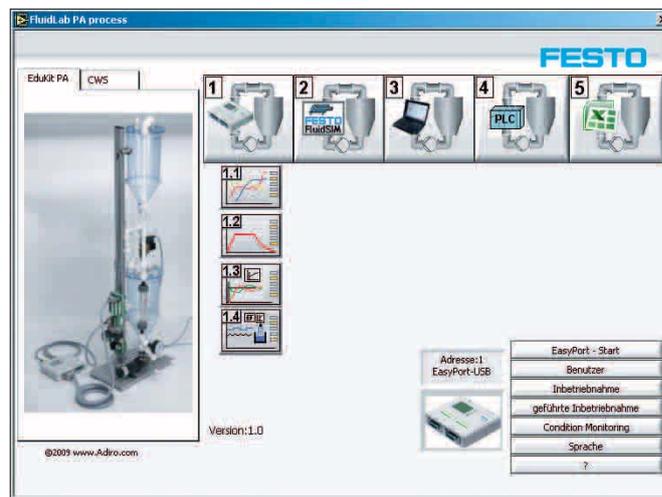
Single licence on CD-ROM de/en/es/fr/sv  
Order no. **544304**

8+1 Multiple licence on CD-ROM de/en/es/fr/sv

Order no. **567139**

# FluidLab® PA process

## Getting started in process engineering



### Simple application of complex relationships

The clear menu structure proceeds from the commissioning of the EduKit PA or Compact workstation to the process engineering using the example of a bottling plant.

### Menu: Guided commissioning

A check list like in the industry. After processing, the system is activated. A commissioning protocol can be printed out for documentation.

### Condition monitoring

Safety and efficiency are checked by means of permanent recording of machine status. Detect and analyses deviations with FluidLab®-PA process.

### Menu: Operation, open- and closed-loop control with the EasyPort

Experience the behaviour of a system using simple process examples. Control-technology operations and continuous and discontinuous controllers are presented. Subsequent analyses bring a valuable, basic realisation, which can be transferred to the general technology. Especially general training aims, such as the concentrated observation and analysis of systems, are encouraged.

### Menu: FluidSIM®

Develop and immediately test control-technology relationships – whether virtual or real. Program one's own process sequence in FluidSIM®: electrical circuit diagram, logic diagram and GRAFCET.

### Menu: Virtual reactor

Animated by a sequencer – observing, analysing and documenting the simulated processes. Production according to customer order and assessing and responding to error messages are in demand.

### Menu: Virtual PLC – acting with STEP 7, PLCSIM or CODESYS® simulation

Learn the basics of PLC programming and the logical processing of binary and analogue signals. Test the program on a virtual or real model.

### Menu: Filling with Excel interface

FluidLab®-PA is transmitted order data from MS Excel via the DDE interface, e.g. the number and volume of the bottles. Conversely, the current status of the plant, for example the level of the storage tanks, is reported.

FluidLab®-PA for **MPS® PA stations** is included.

Single licence on CD-ROM de/en/es/fr  
Order no. **567224**

8+1 Multiple licence on CD-ROM de/en/es/fr

Order no. **567225**

## Either: Simply build it yourself



Every MPS® PA station comes completely assembled and tested on the profile plate with MPS® PA trolley, touch panel and 24 V power pack.

A EduTrainer® Universal with analogue inputs and outputs is required additionally.

For efficient operation in the lesson, we also recommend:

- EasyPort
- FluidLab®-PA
- PID industrial controller
- Workbook with tasks and solutions

Simply commission it ... and you're ready to go!

On request, we can also commission systems for you – particularly in the case of larger systems.

## Or: MPS® PA commissioning service



To ensure that your training projects run smoothly right from the start, we offer:

### 1. Complete technical commissioning of your new system:

The range of applications of the system and the station programs and documentation are presented. Depending on the equipment, commissioning is performed for the following products:

- Station
- PID industrial controller
- EasyPort and FluidLab®-PA

### 2. Training:

You will learn how to operate stations and how to use them in your lesson. Depending on the equipment, training is provided on the following products:

- Station
- PID industrial controller
- Soft PID in the PLC
- EasyPort and FluidLab®-PA

The commissioning and training can thus be adapted to suit your needs.

And if you wish ...

### 3. Useful tips on how to get the most from the MPS® PA:

- Applications
- Enhancements
- Seminars

Are you planning a commissioning and training session? We recommend: Per Station: 1.5 days

Order no. **555647**

# Understanding process automation: Through seminars and workshops



Further training, with the objective of supporting people in companies to deal with current as well as future problems and provide them with new answers – that is the purpose of FestoDidactic.

Festo is developing itself to become an important partner to the process industry. The close coordination with our parent company, Festo AG & Co. KG, ensures that state-of-the-art devices and systems are used in our learning systems. And our trainers have first-hand expert knowledge.

Our orientation and methods set us apart. Our trainers and consultants are practitioners. They are familiar with the tasks of their participants, even those that go beyond technical requirements.

We have high standards. In our courses you will realise the difference between us and other providers: we provide new answers to old questions – answers that help you get that critical step ahead with your operational plans.

Give us a call; we'll be happy to help.

## Valves and fittings – Process control valves

This course provides detailed insights into valve and fitting technology and shows how they are used in the process industry. Participants gain basic knowledge of the individual valve and fitting types and components. In addition, selecting materials and operating conditions/limitations are described in detail. The various types of actuators are also explained with regard to the individual fitting and valve types and all relevant standards are discussed.

## Basic principles and mode of operation of industrial measuring technology and instrumentation

This course provides detailed and sound insights into process engineering. The various measuring types, as well as the different principles, such as pressure, flow rate, temperature and filling level control are treated in detail. Furthermore, control engineering is taught in-depth based on P, I and PID controllers, along with their advantages and disadvantages.

## Closed-loop control circuits

Participants gain detailed and sound insights into process control technology based on P, I and PID controllers and their advantages and disadvantages. Practical exercises with the PA EduKit and the FluidLab®-PA software ensure that the knowledge acquired is transferred into practice.

## Specific customer training, e.g. the basic principles of control engineering

Customised training for employees from the areas of maintenance, service and operational support. With the professional training equipment from Festo Didactic, the following course topics are covered by the training systems on the basis of "learning by doing":

- Cross section of all controller types (P, I, D, PI, PD, PID)
- Control technologies (FluidLab®-PA, industrial controllers and modern PLCs)

## Do you need anything else?

Workshop with more complex tasks for practical operational support and maintenance. For example:

- Exchange and new use of sensors and their integration in a controlled system
- Troubleshooting with control characteristic diagnostics
- Controlled system with reaction time (on request)

# Accessories and optional components



## 1 EduTrainer® Universal A4 rack with Festo CPX-CEC

→ Page 339

CPX-CEC analogue (ON, A) **567275**

## 2 Trolley

The trolley makes an MPS® station a compact and mobile unit. The station is easy to mount on the trolley. The EduTrainer® Universal, size 1, can be inserted and the emergency stop board connected. Appropriate through-holes in the side and rear panels enable orderly routing of cables. The front side is equipped with mountings for panels. The trolley is supplied complete with twin castors.

- Height (including castors, to bottom edge of profile plate): 750 mm
- Width: 700 mm
- Depth: 700 mm

Order no. **541139**

## 3 Operator unit

Touch screen for the adjustable display of processes and data.

Scope of delivery:

- Festo 5.6" 256 colour FED-500 display
- Programming software FED Designer (multilingual)
- RS232 programming cable for loading projects
- Angled plate for mounting onto a slotted profile plate

Order no. **541146**

## 4 PA workpiece set

To fill liquids into the MPS® PA Bottling station. The workpieces are compatible with the MPS® stations. For example, the pot in the Pick&Place station can be sealed with the lid.

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**

## 5 Bottle set

For filling liquids or solid bulk materials in MPS® PA stations, for example a "Filling" station.

The set consists of:

- 20 transparent plastic containers (material: ABS/Terlux)
- Diameter D = 40 mm
- Height H = 60 mm
- Capacity V = 50 ml
- 20 lids

Order no. **567202**

### 1 Tank, round

- The tank can be used with a variety of different mountings in the MPS® PA station for mixing and filling as well as with Edukit PA.
- Volumetric capacity 3 l
- Operating temperature max. 65 °C
- Scaling 0.5 – 3 l
- Incl. mounting material

Order no. **548596**

Other variants on request.

### 2 Water-air cooler

- Aluminium heat exchanger with copper line and flexible plug-in fittings
- 2 24 V DC axial fans with 0 – 10 V adjustable speed input and encoder speed feedback
- Profile foot for mounting
- Connecting cable for I/O connection board
- 1 digital output, optional:
- 1 analogue input 0 – 10 V
- Medium mains water

Order no. **C44000**

### 3 Tool set

- The tool set is an aid to easy working on stations. A practical mini-systainer includes:
- 200 mm steel rule
- Open-jawed spanners size 7, 8, 9, 10
- Adjustable spanner
- Side cutter
- Insulation-stripping pliers
- Wire end sleeve pliers
- Screwdriver set, hex, 1.5 – 6
- Screwdriver, hex, 0.9; 1.3
- Screwdriver, cross-head, PZ02 – short
- Screwdriver, flat, 2.5 x 75; 4.0 x 100
- Screwdriver, flat, 1.2 – 1.6
- Tubing cutter
- Fibre-optic cable cutter
- Workpiece, red, black, silver
- 100 x cable binders 2.5 x 100
- 100 x wire end sleeves 0.25
- 100 x wire end sleeves 0.75

Order no. **539767**

### 4 Cooling unit with heat exchanger

- Refrigerator with temperature controller and 4 l cooling tank with built-in circulation pump
- Cooling output: approx. 380 W at +30°C (RT)
- Temperature range:
  - -10 °C to +40 °C
- Power supply: AC 230 V/50 Hz or 110 V/60 Hz
- Heat exchanger with profile foot
- 2 hand valves
- Connection accessories (flexible tube, connector etc.)
- Overall dimensions (W x L x H): 26 x 37 x 40.5 cm

Order no. **C44001**

### 5 DC wattmeter

- The first step towards discovering potential savings involves measurement of power consumption. The DC wattmeter is a smart meter for training facilities with a 24 V DC power supply and up to 120 W power consumption. All measured values can be read out via data transmission with the integrated Ethernet port. Power consumption is read out as an analogue signal within a range of either 0 to 10 V DC or 4 to 20 mA.

Order no. **573261**

### 6 Replacement filter cartridge

- Replacement filter cartridge for MPS® PA Filtering Station.

Order no. **544303**

1



4



2



5



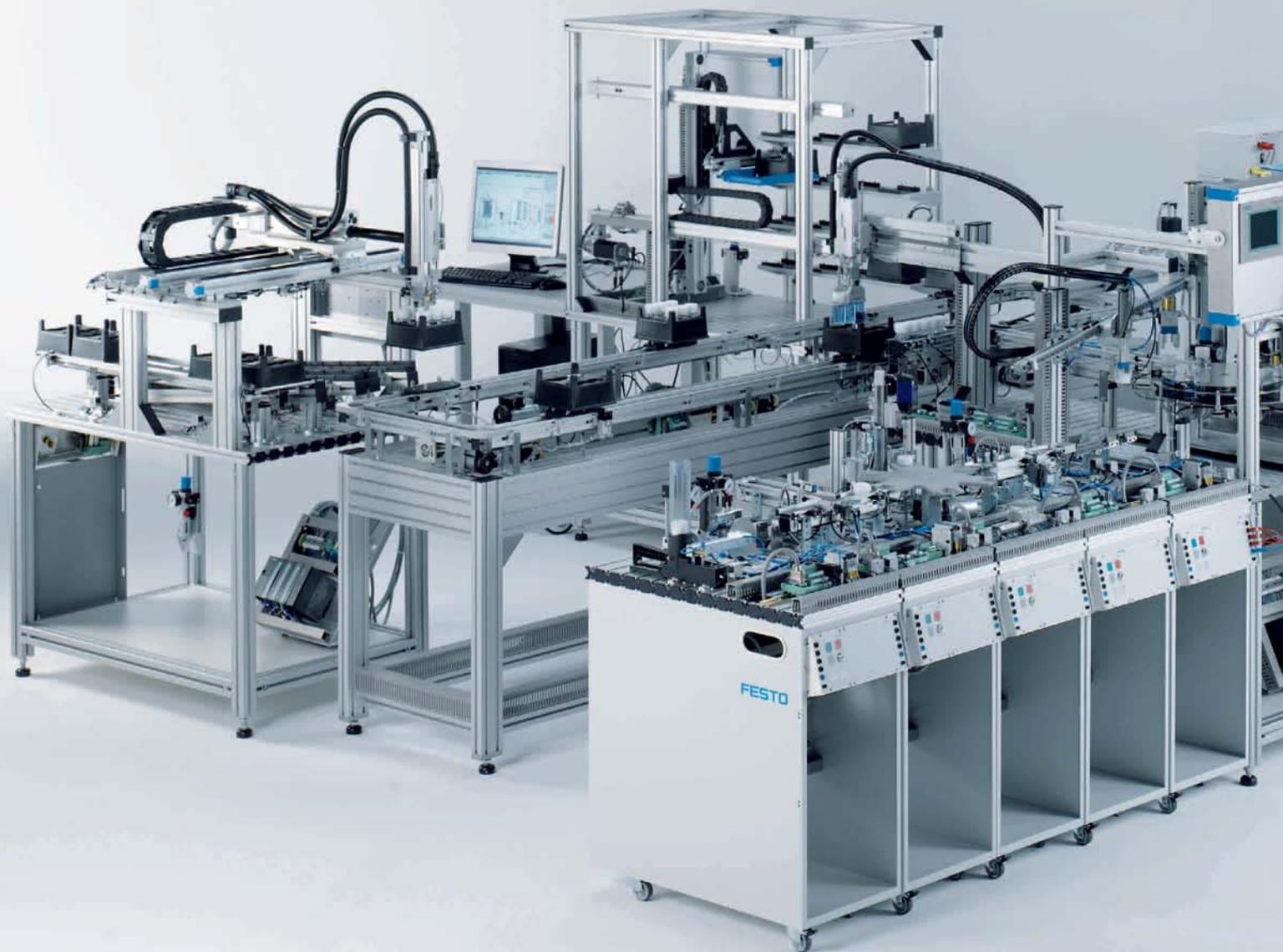
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6



## Hybrid training factories





AFB factory hybrid production.....424

## AFB factory hybrid production



### Megatrend: Hybrid automation

It's a fact that production and process automation have become inseparable in almost all manufacturing environments. Hybrid automation represents the convergence of production and process automation which is more than logical, given the trend towards convergence of the two automation techniques in the so-called hybrid industries.

Hybrid industries are the industries which require systems and solutions for both process and production engineering. The most striking examples are the food, confectionery and tobacco industries and the pharmaceutical industry.

Whether process and production oriented, or hybrid production, Festo Didactic training factories offer a unique range of facilities for training in automation for all industries – from incoming goods, through process and production engineering departments, to outgoing goods.





### The mix is the key

Mechatronics is also making its mark outside production automation. Intelligent drive solutions, featuring high-precision mechanical components, a range of different drives, measured data acquisition and evaluation as well as integrated communications interfaces, ensure safe, optimised process automation too.

### Flexibility

Making processes more flexible, systemising product quality, responding faster to new market trends – the drinks industry has much more to do in this day and age than merely quenching our thirst. On the one hand there is a need to establish and maintain a broad product spectrum and introduce new products in order to generate new demand, while on the other, legislation is increasingly demanding greater transparency of manufacturing processes.



# Innovative technology and innovative learning



## Innovative technology

Pneumatic and electric drive technology from Festo is a byword for innovation in industrial and process automation – from the single product through to the turnkey solution. With the AFB training factory we are for the first time delivering a learning environment which consciously incorporates trends and innovations from all areas of automation technology:

- Electric and pneumatic linear drive units
- Semi-rotary drives and grippers
- Valves and valve terminals
- Sensors
- Vision and control systems

The AFB training factory is designed and equipped like a state-of-the-art industrial plant, based on the automation know-how and engineering experience of Festo.

## Innovative learning

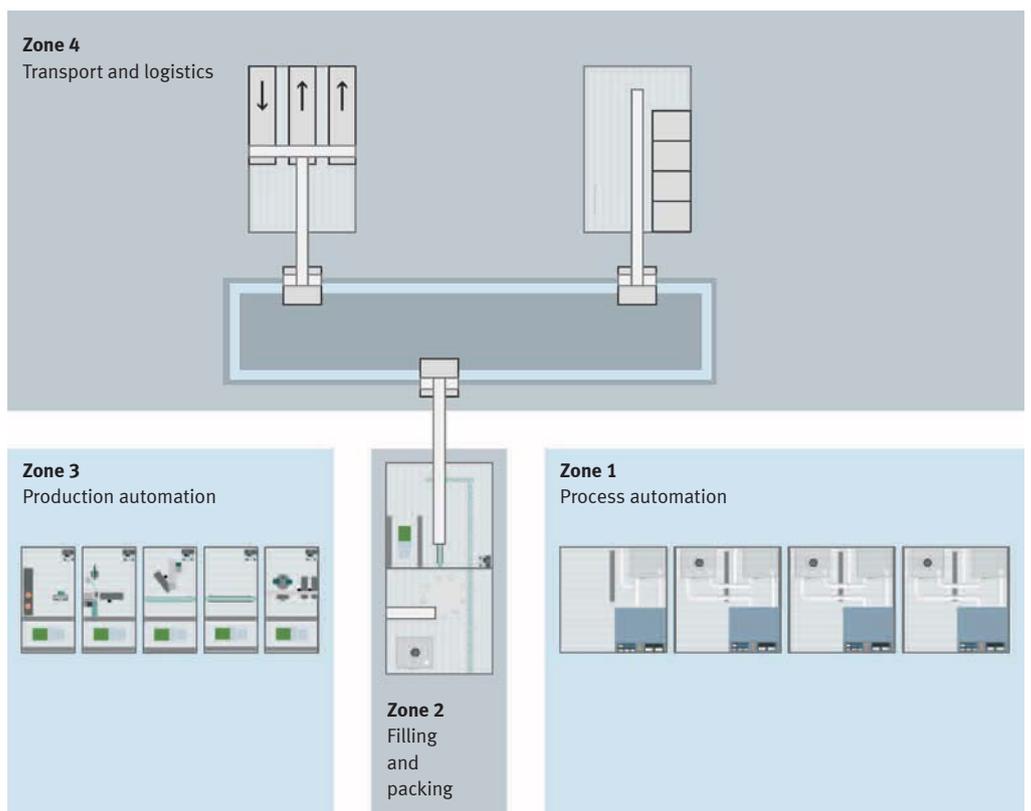
Only by engaging in innovative learning using innovative technology can trainees be optimally prepared for their future work. Comprehensive documentation, software tools for simulation and visualisation and a variety of WBTs complete the AFB range of facilities.



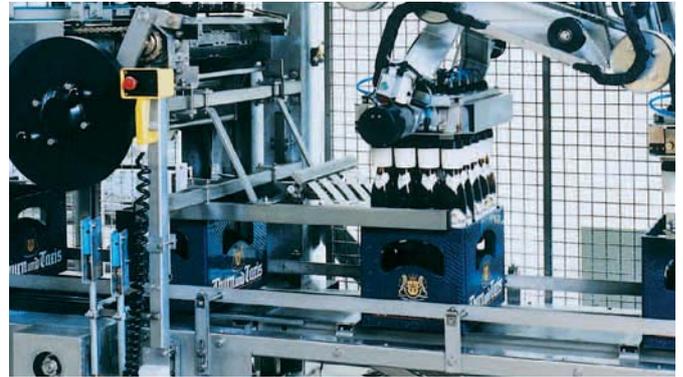
## In focus: the production process for six-packs

Six-packs are produced in four zones of the hybrid training factory. The following processes are mapped:

- Production of the liquid
- Production and feed of the caps
- Bottle feed
- Transport
- Packaging
- Storage
- Order compilation
- Logistics



# The production zones



## Zone 1: Process automation

Filtering, mixing, temperature control; recording, evaluating and controlling typical process variables such as temperature, level, pressure or flow rate; pumping fluids; shutting off pipelines; installing, commissioning or maintaining butterfly valves, slide valves or ball valves. These are just some examples of the wide variety of possibilities in this section of the training factory.

Specialist knowledge of programming, such as recipe preparation, or of plant documentation, such as reading and drafting R-I flowcharts or EMSR location diagrams are key focus areas in the training. Control technology plays a key role in process automation, in order to ensure high product quality. The processes selected for the training factory and the transparent design of the stations enables control technology to be taught in a practical and visual manner.

## Zone 2: Filling and packing

Not only dosing, filling, capping and packing, but also the acquisition, storage and reliable management of product and quality data are key tasks in this section of the training factory.

Technologies such as RFID are becoming ever more prevalent in the production environment, in order to cope with the continually increasing number of product variants and to comply with the more stringent legal requirements in terms of product quality in the food or pharmaceuticals sector. Full recording of all ingredients or components used and the factors influencing the manufacture of a product must be ensured. Vision and sensor systems also play a key role in improving product quality and production flexibility.

In the training factory, for example, the position and fill level of each bottle and the state of completion of each lot is recorded by various optical sensors and a high-speed camera. The production data can be fully tracked by means of RFID tags in the bottle caps. A range of automation components, such as belts with electric drives, various handling units, programmable logic controllers and the latest operator control and monitoring tools, trainees are provided with an ideal platform to learn these key aspects.



### Zone 3: Production automation

Fast cycle times, part gripping, handling, detection, differentiation, separation and mounting are characteristic features of production automation – the classic world of the mechatronics engineer. Programming controllers, adjusting sensors, operating, maintaining and servicing individual lines in a plant are typical activities.

In the training factory in this section the caps are produced, tested and fed to the bottles by the filling station. Programmable logic controllers monitor and control the production process. Various sensors record the end positions of the actuators or identify and differentiate between the work-pieces. Typical actuators used in production automation, such as linear cylinders, swivel cylinders, motors, parallel grippers or vacuum suction cups ensure fast, precise movement.

### Zone 4: Transport and logistics

Almost all production facilities need logistics functions such as materials transportation or warehousing. At the AFB training factory, too, this is a key aspect: Empty six-packs have to be conveyed to the order compilation station or placed in storage. Completed six-packs are delivered just in time, or stored in an interim facility.

Chaotic or systematic warehousing, optimisation of the material flow, planning and prioritisation of orders are the key areas of focus in this section of the factory.

Particular demands are placed on line automation in this section too, however:

- Signals from the transport systems must be sent over long distances to the transport controller.
- High-performance drive units and positioning systems ensure fast, precise movement in the automatic warehouse.
- The communications required for this are based on systems such as the AS interface or CAN.

# AFB training factory



## Optimum operator control

Whether via touch panel, visualisation system or control panel, all the stations and the entire training factory can be operated and monitored in a highly user-friendly way.



## Everything in hand

Whether bottle or six-pack, the professional handling units in the AFB training factory ensure a safe, precise, fast material flow.



## Tried and proven

The MPS® stations, which have been deployed for training purposes thousands of times all over the world, supply the caps in the training factory. The stations particularly enable an optimum level of highly sophisticated training in mechatronics.



## New

Automation technology is taught using state-of-the-art equipment; not just the new MPS® PA stations, but also the automatic warehouse, the filling station and the order compilation station.

AFB-FMRQ-BP-DSPB

On request

**Package**

Comprising:

**Stations**

Zone 1: MPS® PA filtering\*, mixing\*, reactor\*, filling (quality sampling)\* stations

Zone 2: AFB filling and order compilation stations

Zone 3: MPS® distribution\*\*, separation\*\*, processing\*\*, buffering\*\* and handling stations\*\*

Zone 4: AFB pallet transport system, AFB station automatic warehouse and incoming goods and outgoing goods.

**Software and media**

STEP 7 Trainer Package programming software, CIROS®, FluidLab®-PA, Mechatronics Assistant, WinCC

\* Including mobile base frame, touch panel and S7-300 EduTrainer® Universal.

\*\* Including mobile base frame, MPS® control panel and S7-300 EduTrainer® Universal.

**Function**

The AFB training factory produces complete six-packs. All the production steps involved are covered, from production of the liquid through to packing of the containers and storage and shipping of the finished product.

The process automation section of the plant is where the liquid is produced: Raw materials are filtered, mixed together with other ingredients according to different recipes, temperature-controlled and stored ready for use. In-line samples can be taken from the ongoing process before the liquid reaches the filling station. Bottles from a belt conveyor are filled and capped on a rotary indexing table. The bottles are then sealed with machined and tested caps and packed into six-packs. Depending on the order, the completed six-packs

can be placed in interim storage via the belt rotation system or delivered for shipping. Empty six-packs can be conveyed back into the system on roller conveyors and either placed in storage or fed directly into the production process.

**Training content**

The multitude of stations and the technologies embedded in them permit an investigation of almost all relevant areas of control and automation technology.

- Use of RFID technology
- Vision systems and camera
- inspection
- Use and programming of PLCs
- Application of various handling devices and grippers
- Application of various electrical drives (DC, AC)
- Application of frequency converters

**Visualisation**

Either an overview of the complete plant or access to each individual station is available; the visualisation system at the AFB training factory permits monitoring of all signals and provides trend graphs of the analogue process variables, with remote access to the various functions and monitoring of all processes. All training factory stations communicate via TCP-IP with the visualisation computer.

**RFID option**

Full tracking and documentation of the entire production process is demanded in more and more areas of industry. The AFB training factory also makes this possible: Production data such as the recipe or batch identifier are stored on the mobile data carriers fixed to each individual bottle and can be checked prior to shipping. This means that state-of-the-art RFID technology can now be integrated highly demonstratively into automation training.

- Use of multi-axis handling systems for handling and palletising
- Networking sensors and actuators via AS-interface
- Use and commissioning of a CAN network
- Networking automated systems with Ethernet TCP-IP
- Measurement and control of electrical and process engineering variables such as level, flow rate, pressure and temperature
- Process operation and monitoring, system management
- Selection, deployment and control of process fittings

# AFB filling station



The filling station includes a large number of functions typical to the food industry: Bottle feed by conveyor, dosing with a dosing cylinder and filling and capping on a rotary indexing table.

The station can be operated both as a stand-alone unit or in conjunction with other stations.

In stand-alone operation the caps must be fed manually. When operated in conjunction with other stations, the caps can be fed by way of a handling station (MPS®). Filled and capped bottles are forwarded by conveyor to the next station (order compilation).

The liquid being filled is stored in a tank on the station. The tank can be filled manually or way of additional process stations (e.g. MPS® PA).

The station is controlled by a Edu-Trainer® Universal unit and operator control is via touch panel. Individual step and continuous cycle options are available. Status and messages are indicated graphically on the panel.

### Special training aims

- Set-up, wiring and commissioning of an automated station
- Use of pneumatic linear units with variable stroke
- Use of pneumatic linear swivel units
- Controlling and monitoring material flow on a conveyor and a rotary indexing table
- Dosing and filling
- Process operation and monitoring

On request



## AFB order compilation station

With a high-precision 2-axis industrial handling system, 2 by 3 bottles are packed into each six-pack on the order compilation station.

The bottles are carried on conveyor belts to the handling station. A high-speed camera checks the six-packs.

The camera features a built-in controller which handles the complete image evaluation process.

With its TCP-IP interface and the additional CAN master interface, the camera enables wide-ranging communication options.

The station is controlled via an Edu-Trainer® Universal. Different operation modes can be selected on the control panel.

### Specific training content

- Set-up, wiring and commissioning of an automated station
- Use of pneumatic handling unit with gripper
- Controlling and monitoring material flow by conveyor
- Vision systems, quality and process control with intelligent cameras



On request



## AFB automatic warehouse station



The automatic warehouse can hold up to 16 six-packs on 4 levels each with 4 bays. A cartesian 3-axis handling system is used for stock movement. 2 toothed belt axes are driven by intelligent servomotors with an integrated servo amplifier, controller and CAN bus interface.

The third axis is executed as a rod-less linear unit with precision guides.

The station is controlled by an Edu-Trainer® Universal with CAN master. The colour touch panel of the automatic warehouse provides user-friendly operation and monitoring.

Items can be easily taught-in, and stock levels clearly initialised and modified.

### Specific training content

- Set-up, wiring and commissioning of an automated station
- Use of pneumatic linear units
- Electric drive and control technology
- Intelligent CAN bus technology
- Warehousing and logistics
- Process operation and monitoring



On request

## AFB incoming goods/outgoing goods station

Full six-packs awaiting shipping are placed by the pneumatic 3-axis handling unit on one of the two outgoing goods ramps. The handling unit features a pneumatic linear gripper to grip the six-packs.

The axes used are pneumatic linear axes developed specially for industrial assembly and handling systems.

Empty six-packs can be fed in by way of the incoming goods conveyor.

The station is controlled by a Edu-Trainer® Universal. Different operation modes can be selected on the control panel.

### Specific training content

- Set-up, wiring and commissioning of an automated station
- Use of pneumatic handling units with gripper
- Handling technology
- Controlling and monitoring material flow by conveyor belt and roller conveyor



On request



# AFB pallet transport system



The material flow within the AFB lines is implemented by the pallet transport system. The six-packs are conveyed to the individual stations on pallets which are equipped with an identification system. The transport system features 4 stop points, and can be expanded at any time.

The belt segments are driven by 4 AC motors.

The control is handled by a PLC with frequency inverter – professionally housed in the control cabinet. Communication with the stop points is via AS interface. The pneumatic stoppers are controlled using industrial valve terminals.

#### **Specific training content**

- Set-up, wiring and commissioning of an automated station
- Use of AC motors
- Electrical drive technology
- Use of frequency inverters
- Pallet identification
- AS interface fieldbus technology
- Material flow and logistics
- Protection circuits
- Design of industrial control cabinets

On request

## AFB factory, focus on bulk goods



### Found everywhere!

There is a worldwide market behind the term “bulk goods”. In almost every branch of production, bulk goods can be found as raw materials, semi-finished materials or finished parts. Whether building materials, such as sand, gravel and cement, or foodstuffs, such as grain and sugar – bulk goods must be stored, dispensed, weighed, transported or packaged.

### Practical training

The handling of bulk goods requires special know-how. The exclusive use of typical industrial components in the learning stations emphasises the required hands-on experience and ensures the quick transfer of knowledge from training to practice.

### Conveying of bulk goods or complete production process?

The stations are specially designed for training on bulk goods and can be used individually as well as in a network with the stations of the AFB factory. This offers a training factory that includes the complete process chain, from providing and preparing raw materials, to quality testing, packaging, storage and finally the processing of customer orders.

### Everything under control

Stations are controlled using the most modern automation and computer technology. With system visualisation the entire system can be viewed or each individual station can be accessed; it enables the monitoring of signal statuses, the remote access of different functions and the monitoring of all processes, directly on the system using a touch panel or via the master computer.

# AFB stations, dispensing/sorting bulk goods



### Different types of conveying

A wide range of processes are used in production systems for handling bulk goods. It therefore makes sense that these can also be found in the AFB training stations for dispensing and sorting:

### Conveying with a conveyor

In the dispensing station, the conveyor acts as a pressure feed. Corn is dispensed from its container via the conveyor to a funnel and is transported to the next station by means of compressed air.

### Screw conveyor

With the screw conveyor, the bulk goods are carefully conveyed, making optimal dispensing possible. The dispensing screw is driven by a servo motor with a built-in controller.

### High-speed quality checking and diagnostics

Imperfect grains are detected during conveying and automatically separated. This requires the quick detection and reaction of the actuators, which the human eye can hardly follow. To support the diagnostics and commissioning of these fast motion sequences, an intelligent compact camera system with up to 2000 images per second are used in the AFB factory. This means that the latest diagnostic techniques can be taught.



AFB station dispensing bulk goods

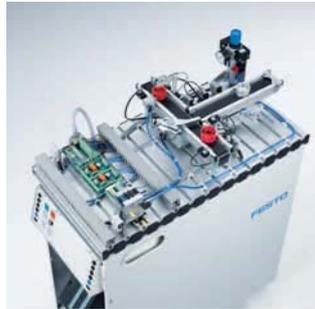
Order no. **AFB-D**

AFB station sorting bulk goods

Order no. **AFB-A**

# One training factory – over 100 different training systems

More than 15 stations can be integrated into the AFB training factory. In addition to the new AFB stations it also features stations from the MPS® family and stations from the new MPS® PA product line.



The unique interface and communications concept enables quick and easy modification of the factory layout.



This means the stations can be deployed at any time individually or in small groups for teaching purposes, and the AFB training factory can be assembled in different project stages.



# Customised solutions

## AFB factory hybrid production



### 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. That's why a qualified requirements analysis is performed before each AFB 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 goals, 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

Festo's experienced technicians and engineers 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 effective tools for translating customer requirements into reality.

### System integration

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

### Customised training

Festo gives you the opportunity to define your training profile. The result? A training course tailored to your exact personal requirements:

- Communication
- Robotics
- Vision system
- Data matrix coding
- Handling technology
- Drive technology
- PLC programming
- RFID technology
- Troubleshooting

### Upgrade

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

### AFB factory – solutions for hybrid production

Do you have special requirements? Numerous installations across the globe have given rise to a range of solutions with a particular focus on hybrid automation. Tell Festo what you need – Festo will build an optimal learning environment closely linked to the actual process.

Solutions for special topics, such as:

- Water treatment
- Cooling and refrigeration technology
- pH value measurement
- Integration of process control engineering
- Identification systems (RFID, barcode)

With its know-how in project planning, instrumentation, design and selection of process components, system integration and programming, through to educational implementation, Festo will help you to put your ideas into practice quickly, reliably and cost-effectively.

### Worldwide references

Universities, colleges and vocational training schools around the world are benefiting from the unique AFB factory system concept. Detailed information on these projects can be found on the Internet:

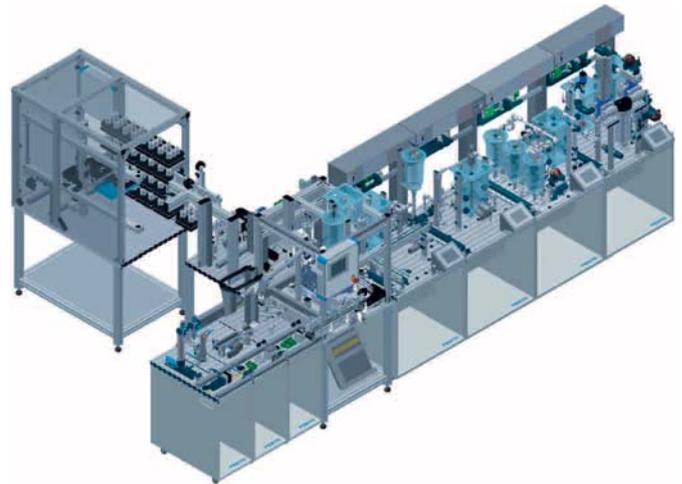
[www.festo-didactic.com](http://www.festo-didactic.com)  
under the heading Services  
→ References

#### AFB learning factory process engineering

In industry, automation solutions are typically used in the process engineering part of a production plant. The AFB learning factory integrates trends and new products from the market leaders of process automation with control systems such as SIMATIC PCS7 and various field-buses and protocols such as Profinet, Profibus PA, and HART. Festo will specify your AFB learning factory for processing engineering together with you.

#### AFB learning factory with process engineering consisting of:

- 1x MPS® buffering, handling, filling, order compilation, filtering, mixing, reactor and quality sampling stations
- 1x AFB automatic warehouse station
- 1x PCS7 AS-RTX
- 2x PCS7 Engineering Stations with process control application
- 1x programming and simulation package

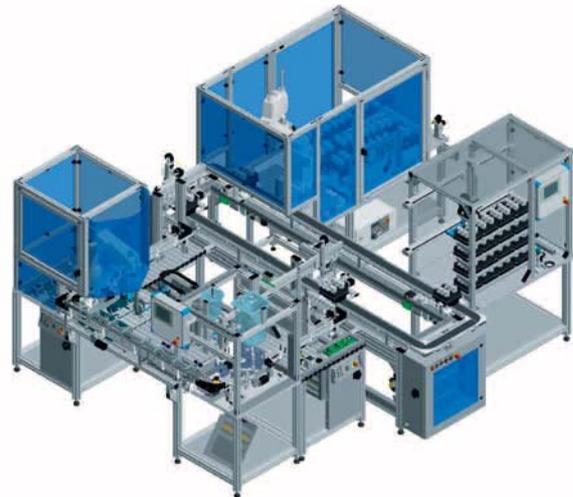


#### AFB learning factory with handling technology and robotics

Different robots such as a 6-axis articulated arm robot for recycling bottles or a SCARA robot for receiving and discharging goods can be integrated into the AFB learning factory. In the AFB learning factory with handling and robotics at RMIT in Australia, multi-axis handling systems with different drives are used for optimal motion. RFID and data matrix coding enable comprehensive, state-of-the-art automation training.

#### AFB learning factory with handling and robotics consisting of:

- 1x MPS® distributing, buffering and handling stations
- 1x AFB station: bulk material conveying, dispensing, sorting, filling, order compilation, automatic warehouse, incoming goods/outgoing goods with SCARA robot, pallet transport system, unpacking and recycling with robot RV-2SDB
- 1x SCADA system
- 1x programming and simulation package

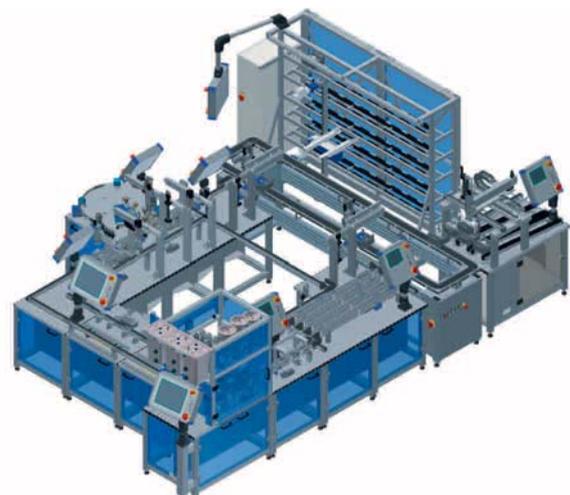


#### Hybrid learning factory "Athene"

The hybrid learning factory "Athene" teaches how to handle media used in the pharmaceutical and food industries. Beginning automation specialists at Siemens in Nuremberg acquire practical knowledge in programming and plant documentation. By means of highly modern control technology, trainees and engineers control temperature, filling level, pressure and flow rate values in order to control pumps, butterfly valves and ball valves in the hybrid learning factory "Athene".

#### AFB learning factory "Athene" consisting of:

- 1x AFB station: filling, order compilation, automatic warehouse, incoming goods/outgoing goods, unpacking, solid recycling and liquid recycling
- 1x route control, filtering, mixing and temperature control process stations
- 1x SCADA system



# EDS<sup>®</sup> – Environmental Discovery System

New





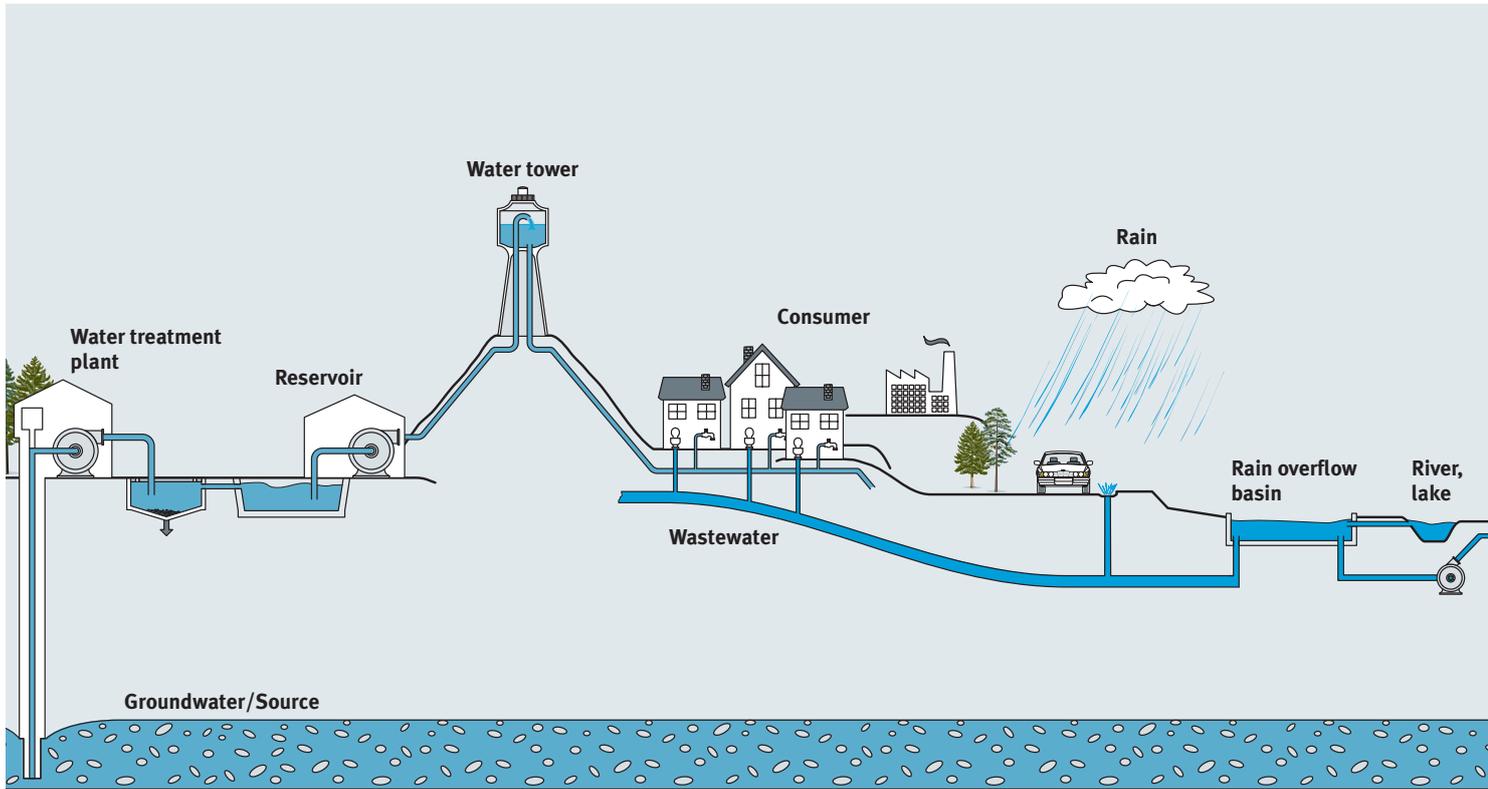
## Water Management

System description .....	444
Stations.....	446
Basic water circuit system.....	458

# EDS® Water Management

## Discovering the water circuit

New



**Clean water for everyone:  
With modern technology!**

Complex systems require responsible operation, as the applications have far-reaching effects on humans, the plant and the environment.

The different EDS® Water Management stations prepare users optimally for these varied tasks and systems with state-of-the-art technology.

**Teaching the water circuit:  
In a small space!**

Experience the complexity of corporate working processes from administration, technology and science in just a few square metres.

All stations are mobile and compact enough to fit on a table-top.



**Experience process control  
engineering**

One click in the control room needs to be thought through, as a switching signal changes the system functions invisibly to the operator. The effects often appear hours later. In the worst case, they can result in water pollution or wasted energy and resources.

EDS® Water Management allows you to experience the effects directly and rapidly.



**Setup times and operating costs –  
Less is more**

Add water, start PCs and software – and you're ready to start water circuit training.

Plastic granules are used as the soiled load and can be air-dried and re-used after utilisation – reducing the operating costs of the training system to water and electricity.



# Water purification station

## Water = Drinking water?

New



### Function

The station represents a basic logic function of water treatment in the form of a water storage system with an overflow rim. A groundwater tank with a submersible pump is required for operation.

Focal points include:

- Setting flow rate values for volume control
- Level measurement via analogue pressure measurement
- Level sensing via capacitive proximity sensors

The training documents reveal how a flocculation reaction is implemented by adding a flocculant, and how sedimentation can occur in spite of the flow.

### Drinking water and chlorine

Chlorine is used worldwide to preserve drinking water. Overmetering not only increases the plant operator's costs unnecessarily, it also pollutes the environment and endangers the consumers. The additional chlorine measurement package with manual metering technology is a 1:1 training scenario for online chlorine measurement. This allows you to learn how to operate a chlorine metering system, and react to malfunctions and optimise the system.

[X]



**Water purification station****8024504**

The station is fully assembled, wired and tested.

**Main components**

3 l tank, including an overflow rim, capacitive proximity sensor, float switch, impeller flow sensor, pressure sensor, 2/2-way solenoid valve, non-return valve, electric connection board, aluminium profile plate.

Including control system with FluidLab®-EDS® Water Management, EasyPort, connecting cables, accessory set and "Getting Started" technical documentation.

For single operation, a water supply tank/ground water (order no. 8024503) is required.

Necessary accessories, also order:

1x Water supply tank/ground water	8024503
1x Tabletop power supply unit → Page 239	

Recommended accessories:

1x Additional chlorine measurement package	8025419
1x DC wattmeter	573261
1x Trolley with plate	8039990
1x Tool set	539767
1x Pipe and tubing cutter	7658

**General training content**

→ Page 445

**Learning content for project work**

- Function of an overflow rim
- Analogue level measurement via a pressure sensor
- Capacitive proximity sensor for level querying
- Basic processes of precipitation, flocculation and sedimentation

**Training content with water supply tank**

- Activation of a pump for flow control
- Regulation variants with capacitive sensors for level control

**Training content with additional chlorine measurement package**

- Measuring chlorine content
- Effects of excessive or insufficient chlorine metering

**Technical data**

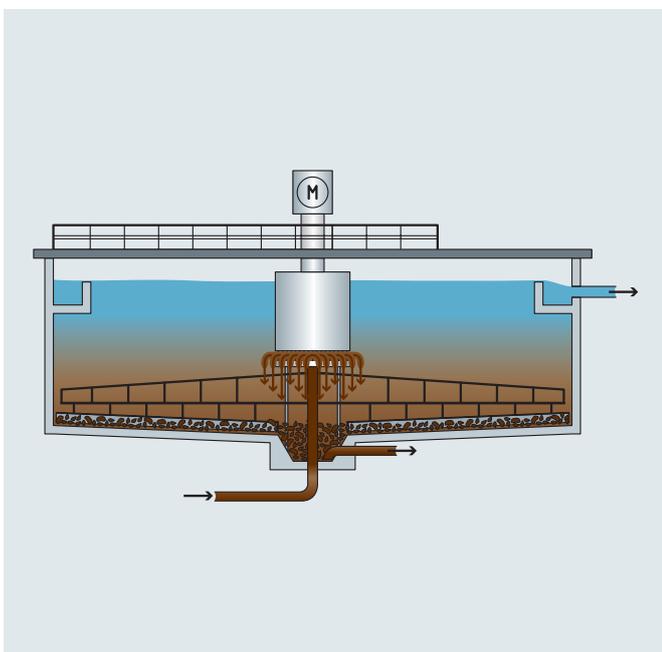
- Water (10 – 15 l)
- Power supply: 24 V DC
- 3 digital inputs
- 3 digital outputs
- 4 analogue inputs
- 1 analogue output
- Dimensions (H x W x D): 355 x 1100 x 400 mm

**Recommended training media**

- Workbook Water purification → Page 76



- Workbook Monitoring, Control and Optimisation
- Workbook Energy Optimisation
- WBT Open- and Closed-Loop Control
- WBT Process Automation
- Water supply technology training set → Internet
- Sewage technology training set → Internet

**Water supply tank/ground water**

Main components:

- Systainer with T-LOC system, 30 l
- Adapter for piping connectors
- Submersible pump
- Prefilter
- Float switch
- Water sieve
- Mobile roller system

Order no. 8024503

**Additional chlorine measurement package**

Optional extension for the water treatment station: Measurement of free chlorine. This package is equipped with a dropping funnel, a membrane-covered, amperometric measuring cell and an indicator that can be parameterised. The measuring cell functions within an operating range of 4 to 9 pH.

Order no. 8025419

# Water supply station

## To the very last drop ...

New



### Function

The station deals with water storage and distribution via an elevated container, e.g. a water tower. The elevated container is filled via a pump, which can be operated in open- or closed-loop control mode. Water is withdrawn via valves. The process command software configures its switching characteristics. Depending on the withdrawal characteristics, feedback to the pump controller and shock loads for wastewater transport can result.

Balancing the water quantity provided with the water quantity delivered is another focus. In many water supply systems, leakages are a significant waste, and elimination by trained personnel is highly important.

Training by simulating a leakage using a valve, and subsequent location of the leakage are useful exercises.

[X]



**Water supply station**
**8024505**

The station is fully assembled, wired and tested.

**Main components**

3 l tank, capacitive proximity sensor, float switch, impeller flow sensor, ultrasound sensor, centrifugal pump, 2/2-way solenoid valve, 2-way ball valve with pneumatic semi-rotary drive, electric connection board, aluminium profile plate.

Including control system with FluidLab®-EDS® Water Management, EasyPort, connecting cables, accessory set and “Getting Started” technical documentation.

For single operation, a water supply tank/ground water (order no. 8024503) is required.

Necessary accessories, also order:

1x Tabletop power supply unit → Page 239	
1x Compressor → Page 240	
1x Compressor accessories	102725

Recommended accessories:

1x Water supply tank/ground water	8024503
1x DC wattmeter	573261
1x Trolley with plate	8039990
1x Tool set	539767
1x Pipe and tubing cutter	7658

**General training content**

→ Page 445

**Learning content for project work**

- Setting the pump to open- and closed-loop control mode and determining the effect on the delivery rate
- Determining the interaction between pressure and flow rate in a piping system
- Controlling the water supply via various valve types and showing the effects of shock loads
- Finding water losses in distribution networks and showing problems in leakage detection
- Measuring/controlling levels with ultrasound sensors
- Understanding and applying the function of pneumatically driven valves and fittings

**Technical data**

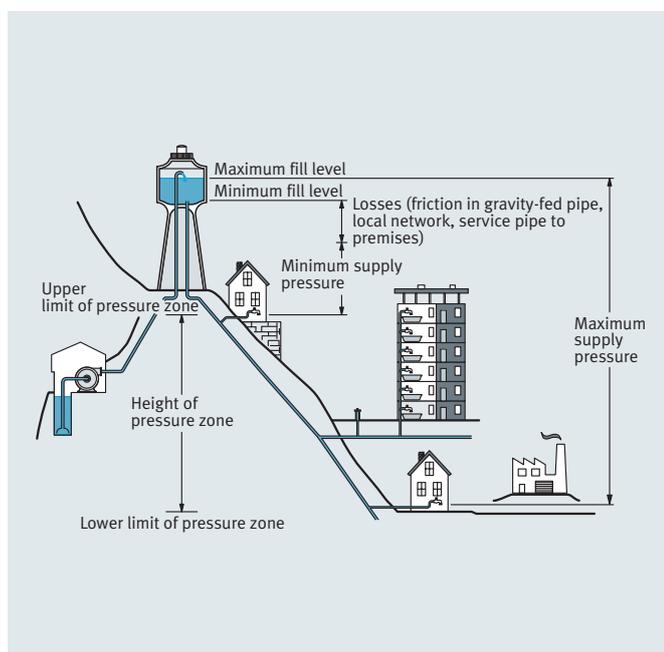
- Operating pressure: 4 – 6 bar (50 l/min)
- Water (10 – 15 l)
- Power supply: 24 V DC
- 5 digital inputs
- 7 digital outputs
- 4 analogue inputs
- 1 analogue output
- Dimensions (H x W x D): 55 x 1200 x 400 mm

**Recommended training media**

- Workbook Water Supply → Page 76



- Workbook Monitoring, Control and Optimisation
- Workbook Energy Optimisation
- WBT Open- and Closed-Loop Control
- WBT Process Automation
- Water supply technology training set → Internet
- Sewage technology training set → Internet


**Water supply tank/ground water**

- Main components:
- Systainer with T-LOC system, 30 l
  - Adapter for piping connectors
  - Submersible pump
  - Prefilter
  - Float switch
  - Water sieve
  - Mobile roller system

 Order no. **8024503**

**DC wattmeter**

The DC wattmeter is a smart meter for training facilities with a 24 V DC power supply and up to 120 W power consumption. All measured values can be read out via data transmission with the integrated Ethernet port. Power consumption is read out as an analogue signal within a range of either 0 to 10 V DC or 4 to 20 mA.

 Order no. **573261**

# Wastewater transport station

## Water becomes wastewater

New



### Function

The “wastewater transport” station teaches control technology for wastewater disposal and the associated processes. It comprises four sub-areas:

- Feeding device for supplying a soiled load
- Sewage pipe section with branch
- Tank with overflow rim as a rain retention and sedimentation basin
- Tank as a primary settlement tank for the biological stage and the option of starting sludge removal via a pneumatically automated fitting.

Plastic granules are used as the soiled load and can be air-dried and re-used after utilisation. Flooding due to rainfall or problems transporting solids can be simulated realistically.

The fluids are supplied to the primary settlement tank via a pump. A flow meter records the flow rate, which is configured via a motor control system of the pump or a proportional media valve.

The media valve functions based on the principle of a pneumatically activated constriction-hose valve. The throttle opening can be configured via air pressure with a proportional pressure regulator valve. That allows the effects on energy efficiency and the flow control quality to be shown clearly.

[X]



**Wastewater transport station** **8024506**

The station is fully assembled, wired and tested.

**Main components**

3 l tank, including overflow rim, 1 l tank, gravity duct, capacitive proximity sensor, float switch, magnetic-inductive flow sensor, ultrasound sensor, centrifugal pump, proportional media valve, proportional pressure regulator valve, pneumatic slide, metering screw for metering solids, electric connection board, aluminium profile plate.

Including control system with FluidLab®-EDS® Water Management, EasyPort, connecting cables, 1x accessory set with sedimentation granules and “Getting Started” technical documentation.

For single operation, a water supply tank/ground water (order no. 8024503) is required.

Necessary accessories, also order:

1x Tabletop power supply unit → Page 239	
1x Compressor → Page 240	
1x Compressor accessories	102725

Recommended accessories:

1x Water supply tank/ground water	8024503
1x Sedimentation granules	8037688
1x DC wattmeter	573261
1x Trolley with plate	8039990
1x Tool set	539767
1x Pipe and tubing cutter	7658

**General training content**

→ Page 445

**Learning content for project work**

- Transporting solid matter in a sewer system using different flow velocities
- Effects of exceeding the hydraulic capacity
- Naming the basic mechanisms that make flushing necessary
- Functions of a rain overflow basin
- Basic functions of sedimentation in a flow basin
- Level measurement with an ultrasound sensor
- Functions of pneumatically driven valves and fittings

**Technical data**

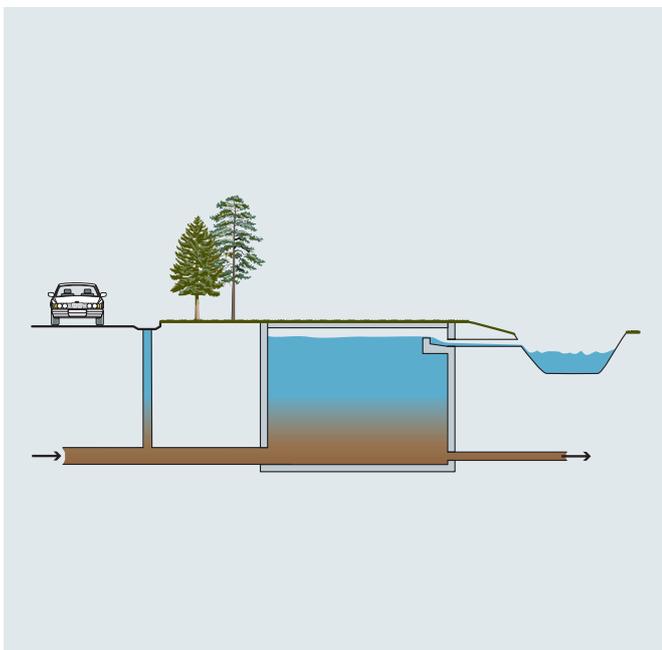
- Operating pressure: 4 – 6 bar (50 l/min)
- Water (10 – 15 l)
- Power supply: 24 V DC
- 5 digital inputs
- 5 digital outputs
- 4 analogue inputs
- 2 analogue outputs
- Dimensions (H x W x D): 1200 x 1200 x 400 mm

**Recommended training media**

- Workbook Wastewater transport → Page 76



- Workbook Monitoring, Control and Optimisation
- Workbook Energy Optimisation
- WBT Open- and Closed-Loop Control
- WBT Process Automation
- Water supply technology training set → Internet
- Sewage technology training set → Internet



**Water supply tank/ground water**

- Main components:
- Systainer with T-LOC system, 30 l
  - Adapter for piping connectors
  - Submersible pump
  - Prefilter
  - Float switch
  - Water sieve
  - Mobile roller system

Order no. 8024503



**Compressor**

Oil-lubricated, extremely quiet (45 dB (A)) compressor. Ideally suited for use in classrooms. With pressure regulator and water separator.

230 V	91030
100 – 120 V	565440

# Wastewater treatment station

## More than just sludge treatment

New



### Function

The station maps the physical functions of wastewater treatment after the sludge treatment and contains an aeration tank and a secondary settlement tank. Plastic granules are used as the soiled load and can be air-dried and re-used after utilisation. The sludge return has a flow measurement system with an adjustable pump for setting and monitoring the sludge return ratio.

The oxygen feeding on the station functions using an electrically adjustable compressed air diaphragm pump. Combined with the available oxygen sensor, there is also an option of extending the oxygen feeding system to a control circuit.

### Economical oxygen regulation

Adding oxygen to water is not only relevant in the wastewater sector, but also in fish breeding or bioreactors.

In order to guarantee energy-optimised oxygen feeding, in-line oxygen measurement is required and must be combined with the oxygen feeding actuator in a control circuit. That avoids unnecessary energy use and possible biochemical malfunction.

EDS® Water Management forms a neutral learning environment on the subject of oxygen feeding regulation. Periodic addition of sodium sulphite ( $\text{Na}_2\text{SO}_3$ ) to the upstream supply water causes a continuous oxygen consumption, thus simulating the oxygen demand of bacteria eating up organic substances in a real biological treatment of wastewater.

Handling with real wastewater is too complex and therefore not planned.

[X]



**Wastewater treatment station****8024507**

The station is fully assembled, wired and tested.

**Main components**

3 l tank, including an overflow rim, 10 l tank, ventilation system, capacitive proximity sensor, float switch, magnetic-inductive flow sensor, centrifugal pump, 2/2-way solenoid valve, electric connection board, aluminium profile plate.

Including control system with FluidLab®-EDS® Water Management, EasyPort, connecting cables, accessory set with sedimentation granules and "Getting Started" technical documentation.

For single operation, a water supply tank/ground water (order no. 8024503) is required.

Necessary accessories, also order:

1x Tabletop power supply unit → Page 239

Recommended accessories:

1x Additional oxygen measurement package	8025418
1x Water supply tank/ground water	8024503
1x Sedimentation granules	8037688
1x DC wattmeter	573261
1x Trolley with plate	8039990
1x Tool set	539767
1x Pipe and tubing cutter	7658

**General training content**

→ Page 445

**Learning content for project work**

- Behaviour of flakes at different flow velocities and different solid loads
- Hydraulic overloading of a wastewater treatment plant and the consequences
- Basic function of aerobic water treatment
- Function of sludge return
- Analogue level measurement via a pressure sensor

**Training content with additional oxygen measurement package**

- Measuring the quantity of dissolved oxygen
- Showing the advantages of continuous measurement/control of the oxygen content

**Technical data**

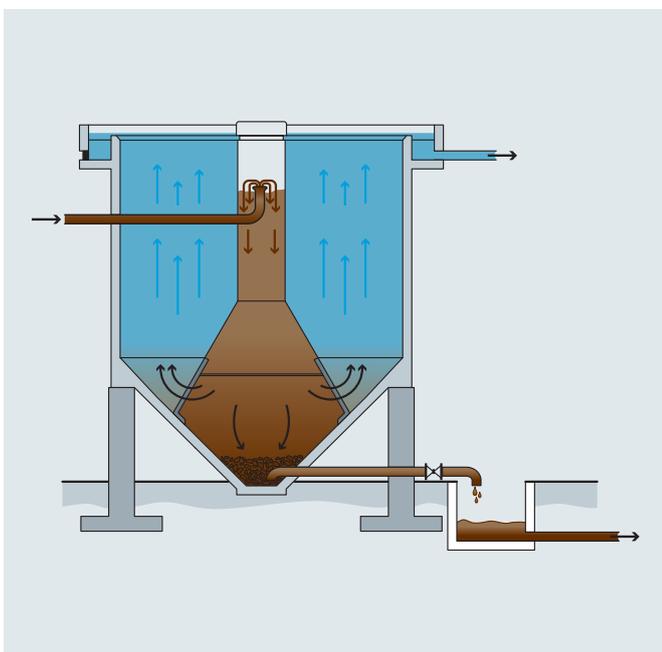
- Water (10 – 15 l)
- Power supply: 24 V DC
- 5 digital inputs
- 5 digital outputs
- 4 analogue inputs
- 2 analogue outputs
- Dimensions (H x W x D):  
710 x 900 x 400 mm

**Recommended training media**

- Workbook Wastewater Treatment  
→ Page 77



- Workbook Monitoring, Control and Optimisation
- Workbook Energy Optimisation
- WBT Open- and Closed-Loop Control
- WBT Process Automation
- Water supply technology training set → Internet
- Sewage technology training set  
→ Internet

**Water supply tank/ground water**

Main components:

- Systainer with T-LOC system, 30 l
- Adapter for piping connectors
- Submersible pump
- Prefilter
- Float switch
- Water sieve
- Mobile roller system

Order no. 8024503

**Additional oxygen measurement package**

Optional extension for the wastewater treatment station. Measuring cell for dissolved oxygen with integrated optoelectronics. Measuring principle: Oxygen-dependent luminescence.

Order no. 8025418

# Sand filtration station

## For the tough jobs

New



### Function

This station focuses on the filtration processes for separating solids frequently used in drinking and sewage technology. As in nature, the sand layers are used to retain the undissolved and suspended pollutants via deep-bed filtration as it trickles through. The pollutants are trapped in the sand layer and are deposited as filter cake. With time, the permeability decreases, the water level above the sand layer rises and is recorded via sensing. The sensor signal shuts off the inlet and starts the backwash process.

Parameterisation of the filtration process is configured on the PC via the enclosed software, such as the change of the backwash time or the pressure adjustment of the purge air to break up the filter cake.

The structure of the different filter layers with quartz sand and quartz gravel in different grain sizes and corresponding monitoring of the cleaning performance through the transparent filter housing is a special aspect.



**Sand filtration station** **8024508**

The station is fully assembled, wired and tested.

**Main components**

3 l tank, including overflow rim, capacitive proximity sensor, float switch, magnetic-inductive flow sensor, centrifugal pump, 4.75 l sand filter unit, proportional media valve, proportional pressure regulator valve, pneumatic valve terminal with 5/2-way solenoid valves, non-return valve, pressure sensor, electric connection board, aluminium profile plate, 1x quartz sand and quartz gravel.

Including a water supply tank/ground water, control system with FluidLab®-EDS® Water Management, EasyPort, connecting cables, accessory set and "Getting Started" technical documentation.

Necessary accessories, also order:

1x Tabletop power supply unit → Page 239	
1x Compressor → Page 240	
1x Compressor accessories	102725

Recommended accessories:

1x DC wattmeter	573261
1x Trolley with plate	8039990
1x Tool set	539767
1x Pipe and tubing cutter	7658
1x Quartz sand and quartz gravel	8039989

**General training content**

→ Page 445

**Learning content for project work**

- Separation of pollutants via a quartz sand and quartz gravel layer
- Deep-bed filtration and structure of a filter cake
- Measurement of pressure loss via the sand filter
- Automated filter process and sand filter backwashing
- Parameterising the process steps
- Functions of pneumatically driven valves and fittings
- Creating a Micheau diagram

**Technical data**

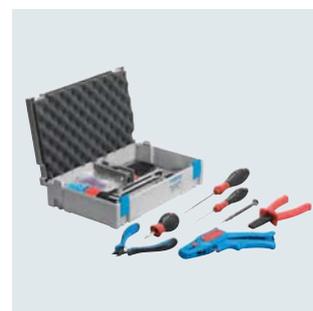
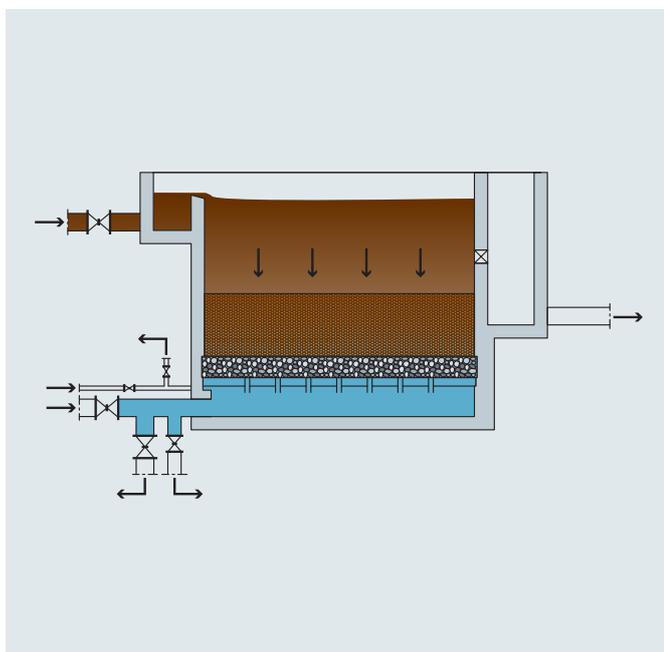
- Operating pressure: 4 – 6 bar (50 l/min)
- Water (10 – 15 l)
- Power supply: 24 V DC
- 6 digital inputs
- 8 digital outputs
- 4 analogue inputs
- Dimensions (H x W x D): 355 x 1350 x 400 mm

**Recommended training media**

– Workbook Rapid sand filtration



- Workbook Monitoring, Control and Optimisation
- Workbook Energy Optimisation
- WBT Open- and Closed-Loop Control
- WBT Process Automation
- Water supply technology training set → Internet
- Sewage technology training set → Internet



**Tool set**

The tool set is an aid to easy working on stations. A practical mini-systainer includes: → Page 421

Order no. 539767



**Quartz sand and quartz gravel**

Used in treating drinking and wastewater as a natural filter material. The filter medium is delivered in various grain sizes to optimise sand filtration.

Order no. 8039989

# Membrane filtration station

## For the finer things

New



### Function

Membrane filtration is highly topical in modern water treatment. Depending on the pore size, the principle is used in water treatment.

Drinking water and wastewater treatment in the form of microfiltration and ultrafiltration is another area of application. The objective of both methods is retaining pathogenic germs, for example. The differences between the cross-flow and dead-end filtration operating modes are covered.

The membrane filtration station maps both processes. In cross-flow operation, the trans-membrane pressure is set for optimal filter performance. The inflows to and outflows from membrane filters can be measured and thus the performance of the membrane can be determined.

The backwash process takes place automatically if the filter performance is insufficient. Backwashing uses system filtrate created previously. The pressure resistance test checks the functionality of the membrane.

Other typical applications include:

- Reverse osmosis for seawater desalination
- Process water treatment in the pharmaceutical industry
- Steam generation in power stations

[X]



**Membrane filtration station 8024509**

The station is fully assembled, wired and tested.

**Main components**

3 l tank, including overflow rim, 3/2-way ball valve, membrane filter unit, capacitive proximity sensor, float switch, magnetic-inductive flow sensor, pneumatic valve terminal with 3/2-way solenoid valves, 5/2-way solenoid valve, membrane pump, proportional media valve, proportional pressure regulator valve, pressure sensor, electric connection board, aluminium profile plate.

Including control system with FluidLab®-EDS® Water Management, EasyPort, connecting cables, accessory set and “Getting Started” technical documentation.

For single operation, a water supply tank/ground water (order no. 8024503) is required.

Necessary accessories, also order:

1x Tabletop power supply unit → Page 239	
1x Compressor → Page 240	
1x Compressor accessories	102725

Recommended accessories:

1x Water supply tank/ground water	8024503
1x DC wattmeter	573261
1x Membrane filter unit	On request
1x Trolley with plate	8039990
1x Tool set	539767
1x Pipe and tubing cutter	7658

**General training content**

→ Page 445

**Learning content for project work**

- Membrane filtration operating modes like filtration and back-washing
- Presentation of the theoretical basic principles of various membrane filtration (micro-, ultra-, nanofiltration and reverse osmosis)
- Process engineering differences between the cross-flow and dead-end filtration
- Automated integrity test for quality testing the membrane via pneumatic actuation and monitoring
- Effect of the transmembrane pressure on the filter performance
- Functions of pneumatically driven valves and fittings

**Technical data**

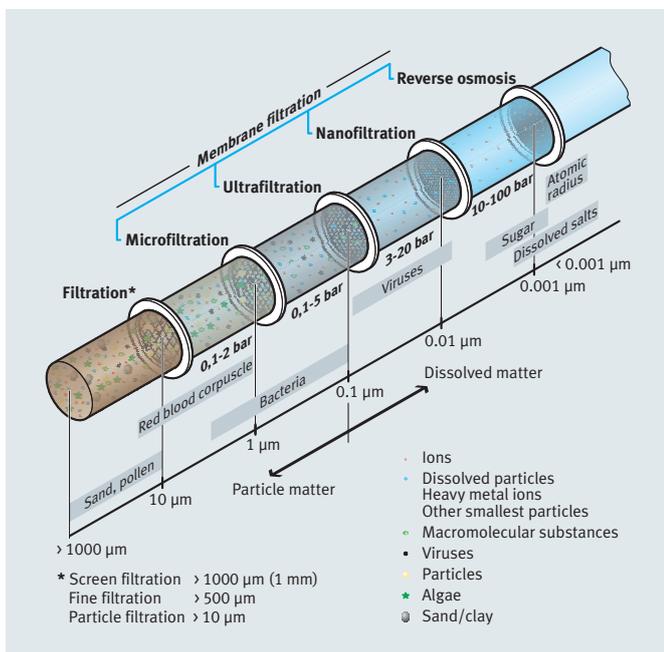
- Operating pressure: 4 – 6 bar (50 l/min)
- Water (10 – 15 l)
- Power supply: 24 V DC
- 8 digital inputs
- 8 digital outputs
- 4 analogue inputs
- 2 analogue outputs
- Dimensions (H x W x D): 710 x 1250 x 400 mm

**Recommended training media**

– Workbook Membrane filtration



- Workbook Monitoring, Control and Optimisation
- Workbook Energy Optimisation
- WBT Open- and Closed-Loop Control
- WBT Process Automation
- Water supply technology training set → Internet
- Sewage technology training set → Internet



**Water supply tank/ground water**

- Main components:
- Systainer with T-LOC system, 30 l
  - Adapter for piping connectors
  - Submersible pump
  - Prefilter
  - Float switch
  - Water sieve
  - Mobile roller system

Order no. 8024503



**Membrane filter unit**

Interchangeable filter unit with a pore size of 0.02 µm. Including connections to the pipe system and blanking plug.

Order no. On request

# Basic water circuit system

Fully equipped – Four becomes one!

New



### Function

Efficiency and economy are not only in demand in the water sector – save time and money with the basic system. The basic water circuit system, comprising all necessary water supply and disposal stations which also function independently of one another.

### Use in a control room

The students initially control the individual stations in manual override using a simulation box.

The included EasyPorts are then used to control and observe the stations via the control software.

One PC, to which all four EasyPorts are connected, controls the complete system.

### For perfect classes

The workbooks with theory sections and exercise scenarios are perfectly customised for the stations and guarantee ideal class preparation.

The learning system components map real processes, making the exercises interesting and informative.

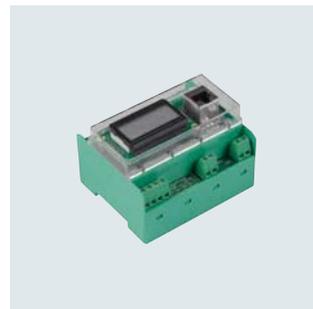
Additional oxygen measurement package



Additional chlorine measurement package



DC wattmeter



Water supply tank/ground water



EasyPort



Simulation box, digital/analogue



**Basic water circuit system** **8024501**

The basic system stations are fully assembled, wired and tested.

The water circuit basic system contains:

- 1x Water treatment station
- 1x Water supply station
- 1x Wastewater transport station
- 1x Wastewater treatment station
- 1x Water supply tank/ground water including cables
- 1x Additional chlorine measurement package
- 1x Additional oxygen measurement package
- 1x Digital/analogue simulation box, including cables
- 4x EasyPorts including cables
- 4x FluidLab®-EDS® Water Management Control Software
- 4x DC watt meters

For single operation, a water supply tank/ground water (order no. 8024503) is required.

Necessary accessories, also order:

1x Tabletop power supply unit → Page 239	
1x Compressor → Page 240	
1x Compressor accessories	102725

Recommended accessories:

3x Water supply tank/ground water	8024503
5x Trolley with plate	8039990
1x Tool set	539767
1x Pipe and tubing cutter	7658
Commissioning service	On request

**General training content**

→ Page 445

**Learning content for project work**

- All training content of the individual stations apply. It is supplemented with the following training content:
- Showing dependences in a water circuit
  - Increasing the degree of complexity by networking systems
  - Identifying interactions of hydraulic flow and delivery rate beyond the limits of the station
  - Getting to know the importance of different pressure zones in a water supply network

**Technical data**

- Operating pressure: 4 – 6 bar (50 l/min)
- Water (30 – 40 l)
- Power supply: 24 V DC
- Dimensions (H x W x D): 2760 x 1150 x 400 mm

**Recommended training media**

- Workbooks EDS® Water Management
- Water Treatment
  - Water Supply
  - Wastewater Transport
  - Wastewater Treatment
  - Monitoring, Control and Optimisation
  - Energy Optimisation
- Pages 76 – 77



- WBT Open- and Closed-Loop Control
- WBT Process Automation



**Trolley with plate**

Stable sheet steel construction with table plate. Dimensions (W x H x D including rollers to bottom edge of profile plate): 700 x 770 x 700 mm

Order no.	8039990
-----------	---------



**Compressor**

Oil-lubricated, extremely quiet (45 dB (A)) compressor. Ideally suited for use in classrooms. With pressure regulator and water separator.

230 V	91030
100 – 120 V	565440

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