Pneumatics and Hydraulics

Learning Solutions Catalog 2026

FESTO



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Magazine

Turnkey Educational Solutions
Tailored to Customer Requirements

„Turnkey educational solutions are an investment in the future. They provide all the required resources and teaching materials from a single source.“

Dr. Nader Imani,
VP Global Education

01



Concepts for Every Challenge

Complete Solutions from Planning to Installation

Customized solutions from a single source
Every educational institution has different requirements in terms of budget, space, performance level, and technology orientation. Although their needs differ, they all have one goal in common: to ensure that young people in education or employees on the labor market get the best possible qualifications.

Is it your task to get the most out of a small space, or to make sure that new laboratories are optimally planned? Does everything revolve around hardware, software, or training in fluid technology? Or are you concerned about the topic of digitalization and simulation as a way of transferring knowledge of basic technologies?

Festo Didactic has been providing answers to customers' questions all over the world for over 50 years, and develops a customized complete solution for every challenge. This offers educational and training facilities a consistent and future-proof concept from a single source. And students will be able to get exactly the technical qualifications that are currently in demand on the job market.


Industry 4.0
Pneumatics and Hydraulics
Metal Technology
Mechatronics/ Factory Automation
Industrial Trades
Electronics and Electrical Engineering
Building System Technology
Renewable Energy
Process Automation and Water Technology

For Different Age Groups and Technologies

Flexible Room Concepts





One space – a wide range of technologies
Ideally, you would be teaching apprentices from different age groups and different disciplines in the same space. However, how spaces can be used is often limited by inflexible furniture.

Our flexible room concepts offer the opportunity for training across different technologies. They consist of complete laboratory workstations with mobile furniture, workbenches, and machines. Depending on the lesson, students can work in project groups or focus on self-study phases. Even when setting up, we are already thinking about expansion options in the future.

The ingenious TecDesign system offers the greatest possible flexibility for practical teaching. Flexible swivel arms with integrated connections supply the room with compressed air, energy, and data in the shortest possible time. The space is thus used in different ways and to optimum effect as well as to full capacity. This benefits teachers and students alike.

→ **Discover laboratory variants in the "Room concepts" brochure**

Scan me

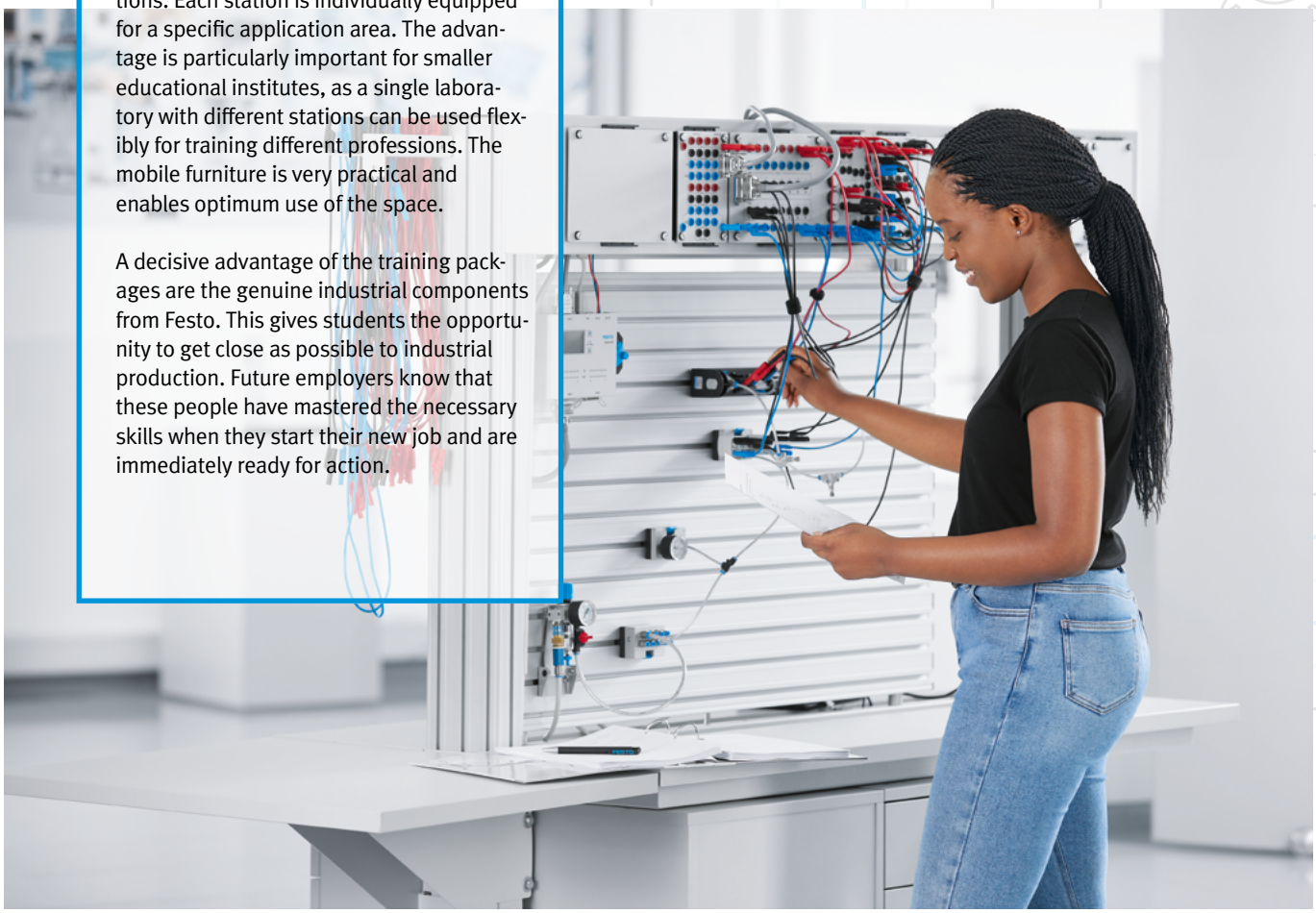
Optimal Learning with Flexible Furniture

Innovative Technologies in Modern Workplace Systems

Learnline
Theory is followed by practical application. The workstation systems in the Learnline series provide an ideal training environment for education and training in automation technology. The modular combination of furniture and components leaves nothing to be desired, for training on basic technology all the way to digitalization.

Innovative technologies in pneumatics and hydraulics are easy to teach at these stations. Each station is individually equipped for a specific application area. The advantage is particularly important for smaller educational institutes, as a single laboratory with different stations can be used flexibly for training different professions. The mobile furniture is very practical and enables optimum use of the space.

A decisive advantage of the training packages are the genuine industrial components from Festo. This gives students the opportunity to get close as possible to industrial production. Future employers know that these people have mastered the necessary skills when they start their new job and are immediately ready for action.





Frameline
With this highly flexible solution for electrical engineering, the laboratory is already equipped for tomorrow. The equipment can be expanded modularly and quickly adapted to individual requirements.

Traditional frontal teaching has had its day. Learning means discovering, trying things out, and having fun. The best way to achieve this is through variety: discussions, creative learning, and sharing ideas are important. The Frameline furniture series is particularly suitable for teaching people individually, in pairs, or larger groups. It takes just a few moments for teachers to rearrange the mobile modules as required.

Are ergonomic seating, an orderly room, and multi-media all part of training for you? All these different elements are of course an integral part of the program in the fully equipped workstation systems. Because we want teachers to concentrate fully on what they do best: giving exciting lessons.

→ **Our brochure "Furnishing individual learning spaces" shows you all the options**



Scan me

Training in The Automotive Industry

Customer Case Study: Daimler Training Center in Stuttgart, Germany





One room – many possibilities
Learning spaces and laboratories are often unchangeable. So how do you get the most out of small spaces and how can you teach different disciplines in the same room? Festo Didactic offers individual and creative solutions for every room.

A good example is the Daimler Training Center in Stuttgart, Germany. Two learning rooms were equipped with multifunctional equipment. This includes the flexible TecDesign system, as well as mobile furniture and learning stations. It is now possible to teach students from different year groups and different disciplines on the same day. Many areas are covered at the Daimler Training Center: pneumatics and electropneumatics, mechatronics, factory automation, and the basics of Industry 4.0. Even non-technical lessons such as presentations or group work are now easy to organize. The customer benefits are obvious: minimize vacancies, improve capacity utilization, and simplify lesson planning.

→ **You can find more details about the learning space here**

Scan me

Training Packages
Get to Know the Function and Features of Technologies

”

Training packages are the ideal combination of hardware, software, didactically prepared learning content, and practical exercises.

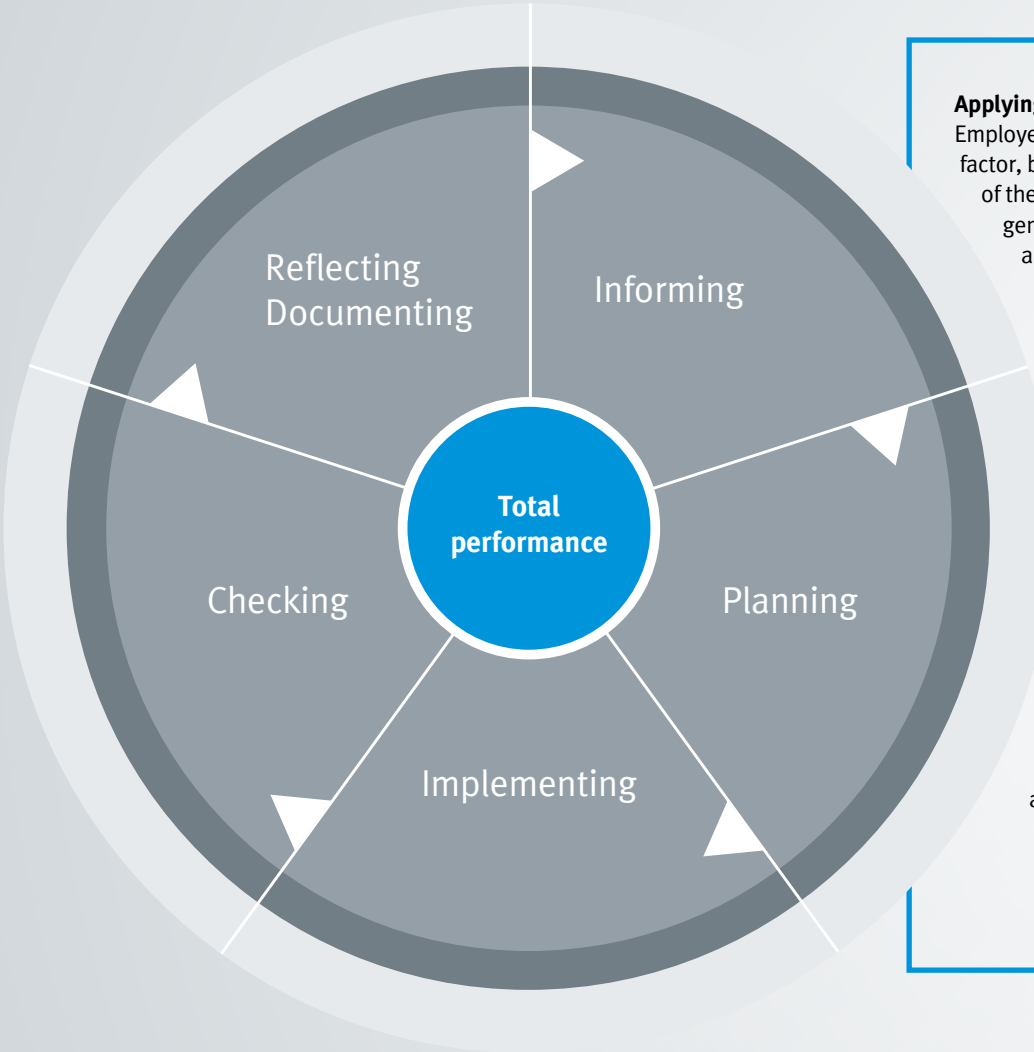
“

Nicola Bauer,
Head of Factory Automation

02

Developing and Implementing Skills

The Educational Concept for Full Competence



The educational concept for total performance.
Our educational concept for the training modules.

Applying key competencies
Employees with the right skills are a success factor, because people are also at the heart of the industrial transformation. Intelligent machines need employees who are well trained and have the skills to take on responsibility.

The concept of the complete action helps them to do this as they follow a cycle of five steps. They can identify their own position in the process at any time.

Going through the entire process is one of the requirements of the economy for skilled workers. It guarantees the quality of work processes. In our training packages and learning systems, students apply both the skills they have acquired and the concept in practice.



The concept using the example of simulation software

Informing
- Reading the problem description in the workbook
- Understanding the assignment
- Acquiring any missing knowledge

Planning
- Designing a circuit with FluidSIM®
- Generating a circuit diagram with a bill of materials

Implementing
- Designing and commissioning the circuit on a workstation system using the training packages
- Simplified, accessible, and convenient

Evaluating
- Comparing the target and actual state and specific troubleshooting, e.g., using measuring technology components

Reflecting, documenting
- Evaluating the result, optimization and professional documentation using the worksheets in the workbook and FluidSIM CAD drawings

Comprehensive Basic Knowledge of Fluid Technology

Pneumatics and Hydraulics Training Packages

Pneumatics training packages
Pneumatics is a core element of drive technology in industrial production systems. As an automation specialist, Festo offers training packages in pneumatics for almost every application and for every level.

The training packages are specially tailored to their application. Matching hardware, software, and workbooks are combined to create a comprehensive learning experience. The modular packages, covering topics from basics to specialization, build on each other, creating a logical learning paths for getting to grips with the technical basics.

And why not take a different approach? Learn or teach wherever you want. The mobile training packages TP 101 and 201 make for exciting new learning environments and ensure your training rooms will be fully occupied.

→ **You can find our learning solutions on digitalization on page 28**

Hydraulics as energy-efficient drive technology
Compared to other drive technologies, it is capable of transmitting high forces and torques without consuming large amounts of energy.

As in all technologies, digitalization is also becoming increasingly important in hydraulics. Our training packages make it easy to learn how to monitor and analyze data. The next logical step is predictive maintenance, which helps to avoid downtime.

Energy efficiency and preventing production disruptions protect our environmental resources. This is how technical education can make a contribution to sustainability.

→ **You can find our learning solutions on the Digital Factory on page 162**





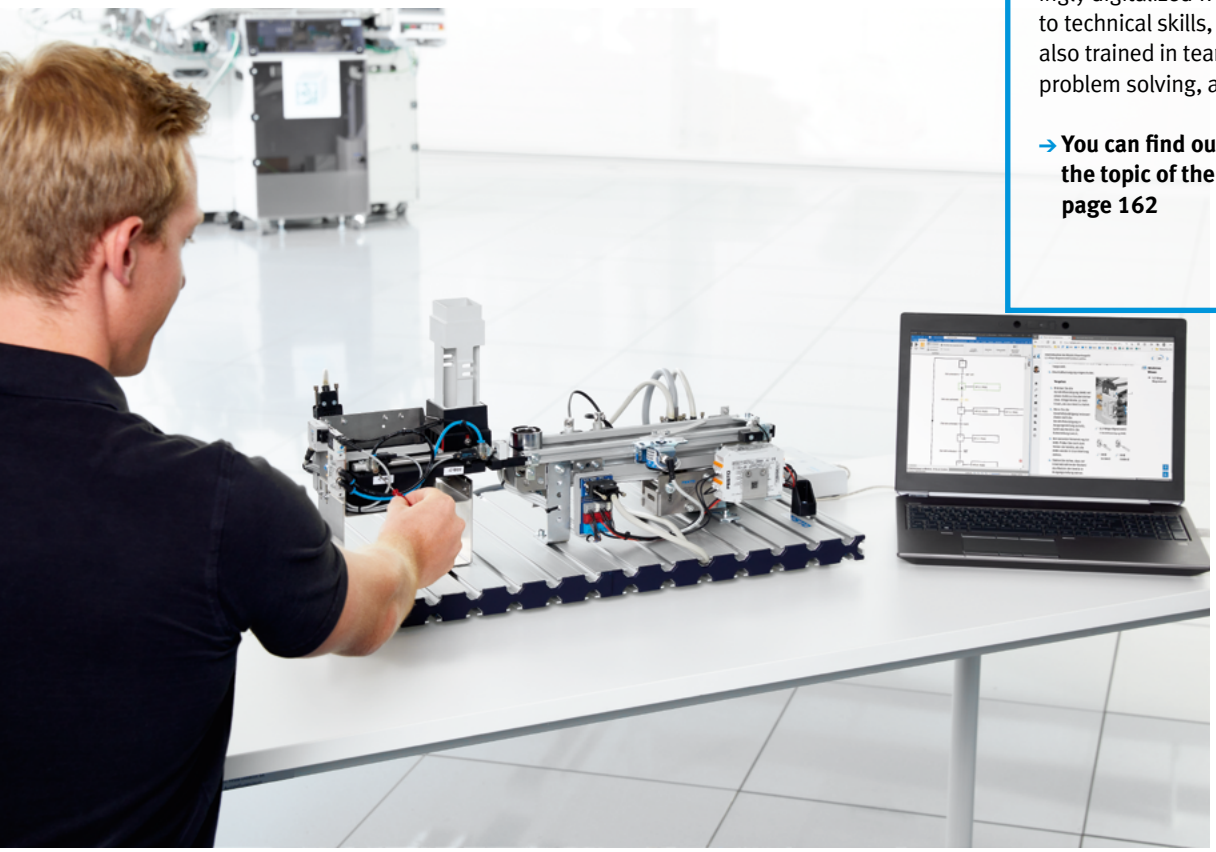
The Indispensable Control Systems and Data Management

The Learning Path for Digitalization and Networking

The learning path for digitalization
The case study of the German metalworking profession makes it clear that the learning path for digitalization prepares students for the challenges of digitalization. They build up important skills, e.g., an understanding of digitally networked production processes or the programming of programmable logic controllers (PLCs).

The learning path helps metalworkers to adapt to the requirements of an increasingly digitalized working world. In addition to technical skills, the young specialists are also trained in teamwork, communication, problem solving, and analytical thinking.

→ **You can find our learning solutions on the topic of the Digital Factory on page 162**





Connected world
By networking PLC systems, production processes can be efficiently and intelligently controlled and monitored. Operating data is recorded, visualized, and controlled, enabling production to be optimized.

Networking also allows machines and systems to be monitored and controlled remotely. When trends, patterns, and optimization potential are identified, production processes can be continuously optimized and efficiency will increase.

The networking, operation and monitoring of PLCs thus contributes to intelligent networked production, which in turn leads to greater flexibility, efficiency, and quality.

→ **You can find our learning solutions on the topic of the Digital Factory on page 162**

Conserve Resources and Avoid Downtime

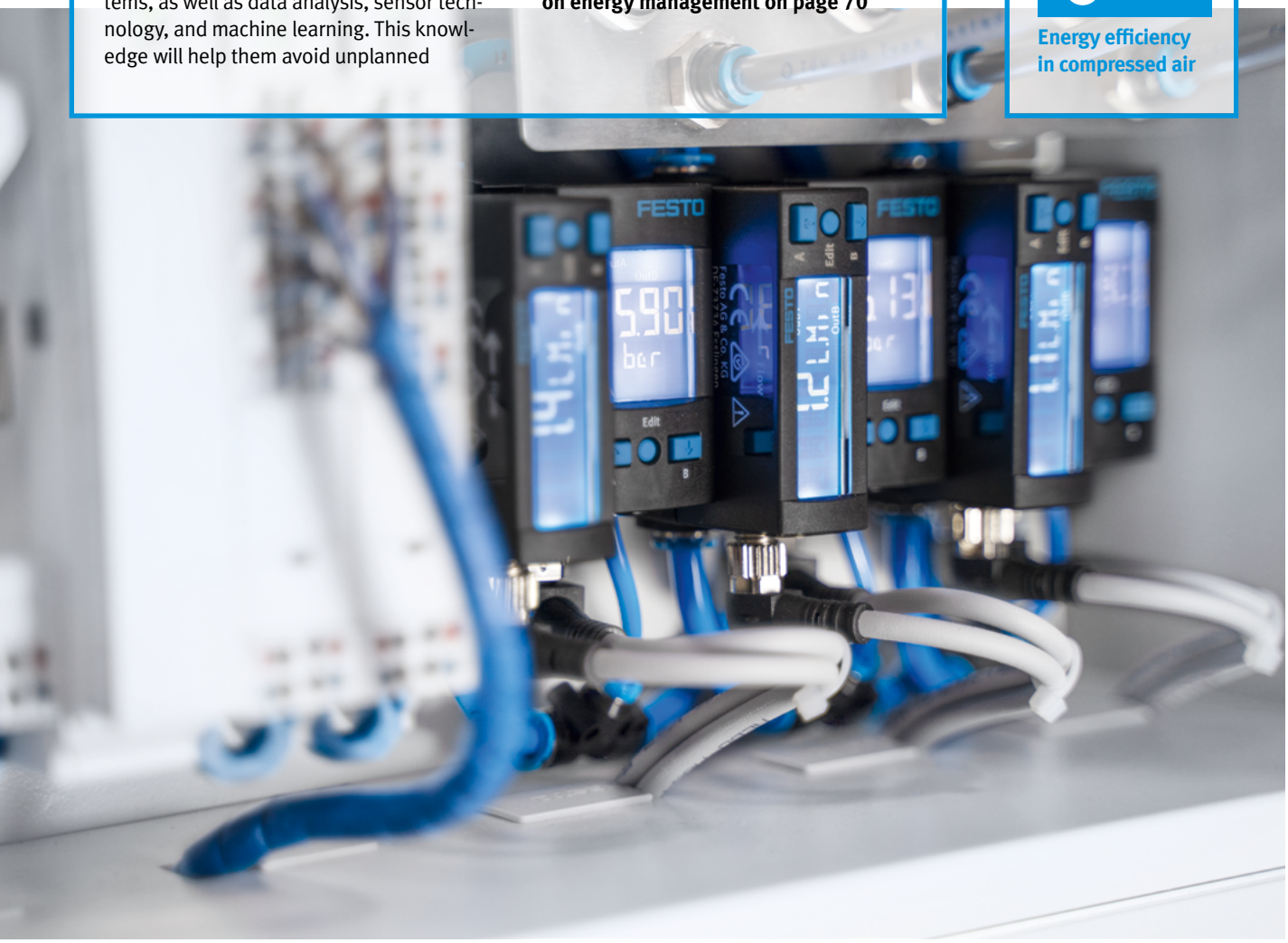
Energy Management...

Sustainability in production
Energy management means that the energy consumption in systems and processes are efficiently monitored, controlled, and optimized. In predictive maintenance, data analysis helps to monitor the condition of machines and predict upcoming maintenance requirements.

Specialists in industry today need new skills. This includes dealing with energy sources, measuring and monitoring systems, as well as data analysis, sensor technology, and machine learning. This knowledge will help them avoid unplanned downtime, extend the service life of the equipment, and reduce costs too.

Optimizing operating processes and making systems more reliable is easier than you might think. Our learning solutions for energy management or sensor technology guide you step by step towards the skills that are in high demand in modern and sustainable industry.

→ **You can find our learning solution AirCS on energy management on page 70**





Energy savings



Energy efficiency in compressed air



… and Predictive Maintenance

Minimizing risks and optimizing processes
In our globalized world, no company can afford an idle production line. It is therefore all the more important to have highly trained employees who know how to monitor the condition of the equipment, thus preventing potential breakdowns. Training institutes are called upon to equip young professionals with the right skills.

Condition monitoring focuses on the continuous monitoring of system processes. This allows deviations from normal operating parameters to be detected in good time. The advantages are longer system availability, risk minimization, and improved maintenance.

As an automation specialist, Festo knows the needs of industrial companies. Festo Didactic uses this up-to-date industry know-how to develop modern learning solutions for educational institutes. Take a look at the Intelligent Sensors training package and how it can be flexibly integrated into your lessons.

→ **You can find our learning solution on the subject of predictive maintenance at 62 and 94**

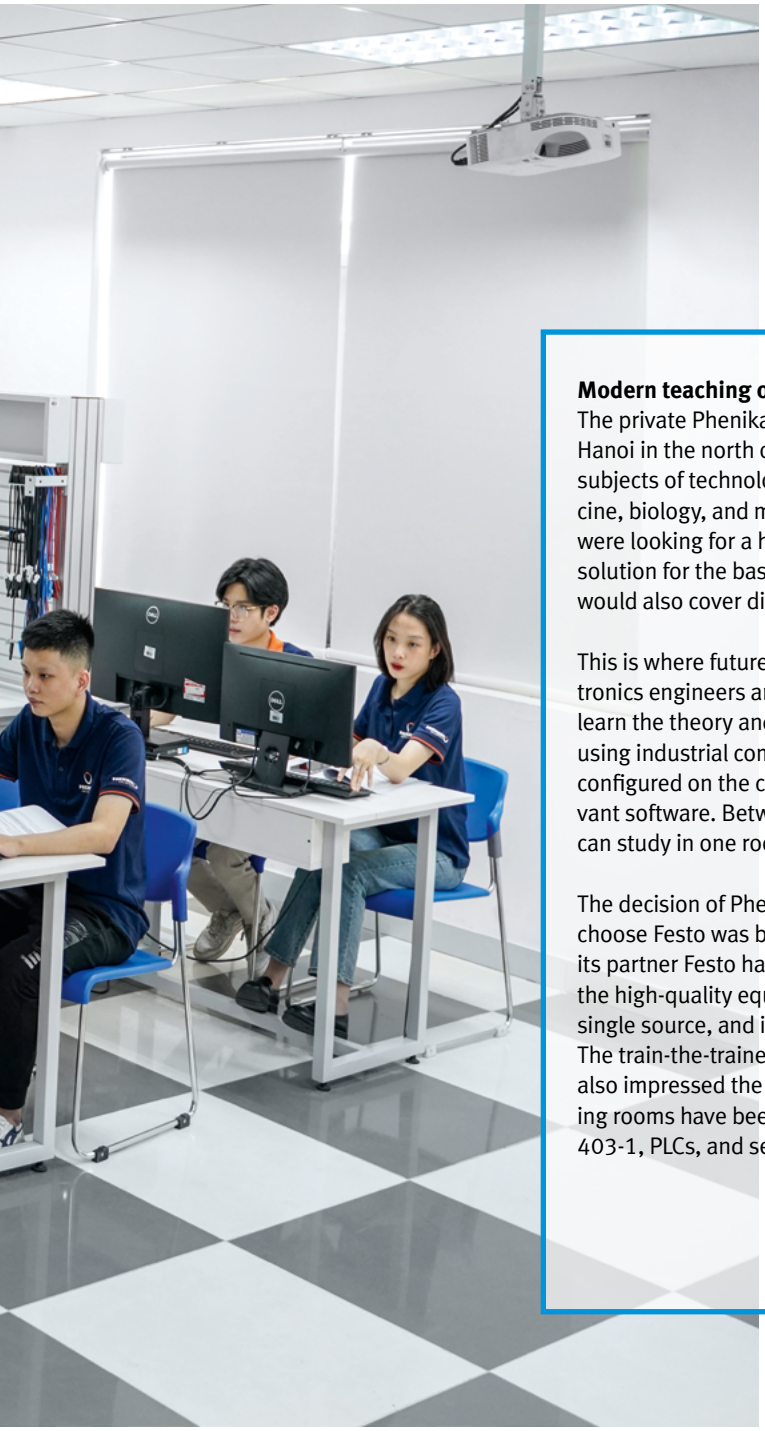
Scan me

Customers Rely on Quality and Training

Customer Case Study: Phenikaa University in Hanoi, Vietnam







Modern teaching of basic technology
The private Phenikaa University is located in Hanoi in the north of Vietnam. It teaches the subjects of technology, economics, medicine, biology, and materials. The managers were looking for a high-quality learning solution for the basics of pneumatics that would also cover digitalization.

This is where future mechanical and mechatronics engineers are trained. They first learn the theory and then put it into practice using industrial components. Interfaces are configured on the computer with the relevant software. Between 14 and 20 students can study in one room at the same time.

The decision of Phenikaa University to choose Festo was based on several reasons: its partner Festo has a local office in Hanoi, the high-quality equipment comes from a single source, and is cost-efficient to use. The train-the-trainer program for teachers also impressed the customer. Other learning rooms have been equipped with MPS 403-1, PLCs, and sensors.

Digital Learning

Digital Learning Support for Efficient Learning Processes

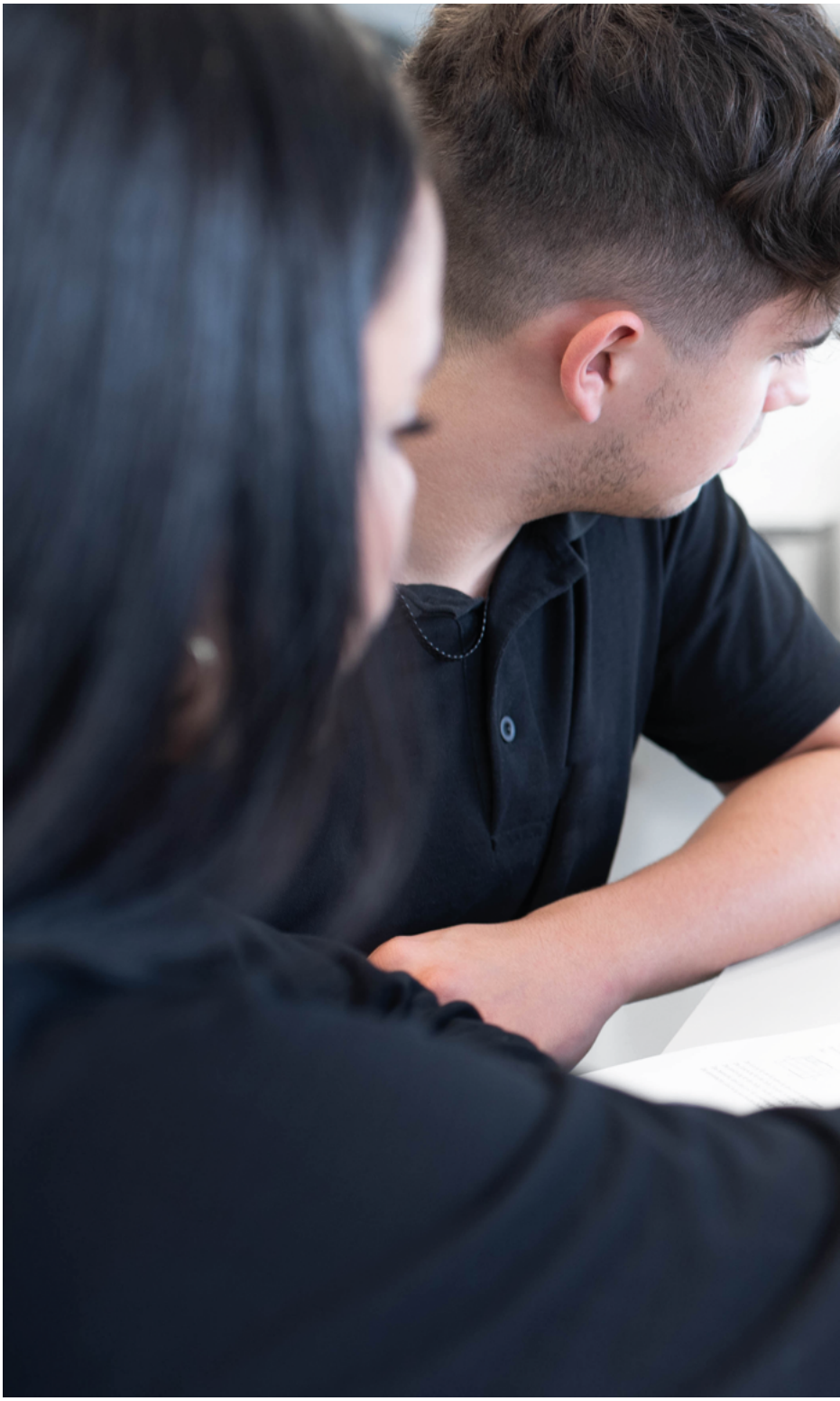
„Digitalization is changing not only what we learn, but also how we learn. Technological advances are creating innovative forms of learning, and with them new opportunities for more sustainable learning success."

Daniela Follmer,
Product Management Digital Learning

03

A New Form of Teaching

Digital Learning Combines Theory and Practice



The digital transformation is shaping and permanently changing the world of education. In technical education, in particular, it is important to impart more than just theoretical knowledge. Students must also be given the opportunity to apply and deepen the skills they have acquired directly in practice. This is precisely the objective of the digital learning solutions from Festo Didactic.

The combination of theory and practice is easy to implement with the Festo LX Digital Learning portal. It offers plenty of training content on the basic technologies of pneumatics and hydraulics.

→ **You can find our learning solutions for Festo LX on page 164**

With our comprehensive FluidSIM software solution, virtual simulations and models of pneumatic, hydraulic, and electrical circuits can be designed.

→ **You can find our learning solutions for FluidSIM on page 168**


FESTO
"Simulation Circuit"

Tomorrow's Specialists Learn Digitally

Customer Case Study: Freudenberg in Weinheim, Germany



The Freudenberg company in Weinheim, Baden-Württemberg, Germany, is a global and innovative provider of technology. As a training company, Freudenberg attaches great importance to state-of-the-art digital training for its students. The young specialists use Festo LX to learn complex topics in short units, ensuring that the link between theoretical knowledge and practical application focuses on professional performance. Festo LX is used in close combination with pneumatic and hydraulic components and with elements of metalworking equipment, such as lathes and milling machines.

“Festo LX offers a range of courses that are optimally linked to the Festo hardware. It provides user-friendly layouts for creating your own content, which helps to find simple ways to communicate complex topics,” explains Martin Bechtold, Technical Trainer for Digitalization at Freudenberg.

Scan me



WorldSkills
We Create Winners

„Vocational competitions in Germany and abroad bring together decision-makers from education, business, and government. Together, they are shaping the professions of the next generation."

Elfi Klumpp,
Head of Partnership Development Global Education



Inspiring Young People for Technical Professions

Festo Promotes Professional Competitions

Strong partnership
The WorldSkills Association has been organizing national and international vocational competitions since 1950. Thousands of young professionals around the world demonstrate their skills in over 60 training occupations year after year.

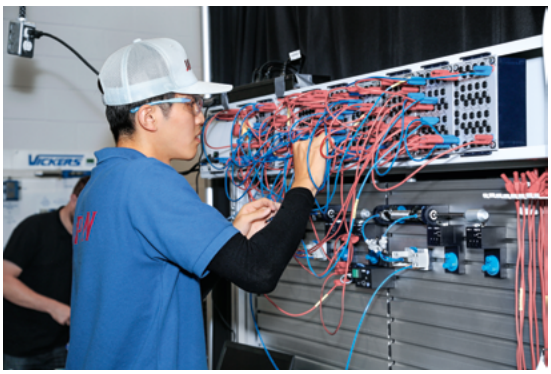
Festo and WorldSkills International have enjoyed a close partnership since 1991. As a Global Industry Partner (GIP), Festo introduces the latest technology trends from the industry to the vocational competitions.

Today, we sponsor the subjects Mechatronics, Industry 4.0, Water Technology and Renewable Energy. Since 2008, WorldSkills Europe and Festo have been working together to promote training in technical professions. In recognition of this cooperation, Festo received the Premium Sponsor award from WorldSkills Europe in 2022.

Well-trained specialists are increasingly in demand. At Festo, we actively support the training of skilled workers by promoting vocational training, making it better known and ensuring it gets better appreciated. International championships act as a magnet for participants and visitors alike and inspire young people to take up technical professions. In order to bring about technological change, they need to put in a top performance.

→ **You can find our commitment to WorldSkills on our website**







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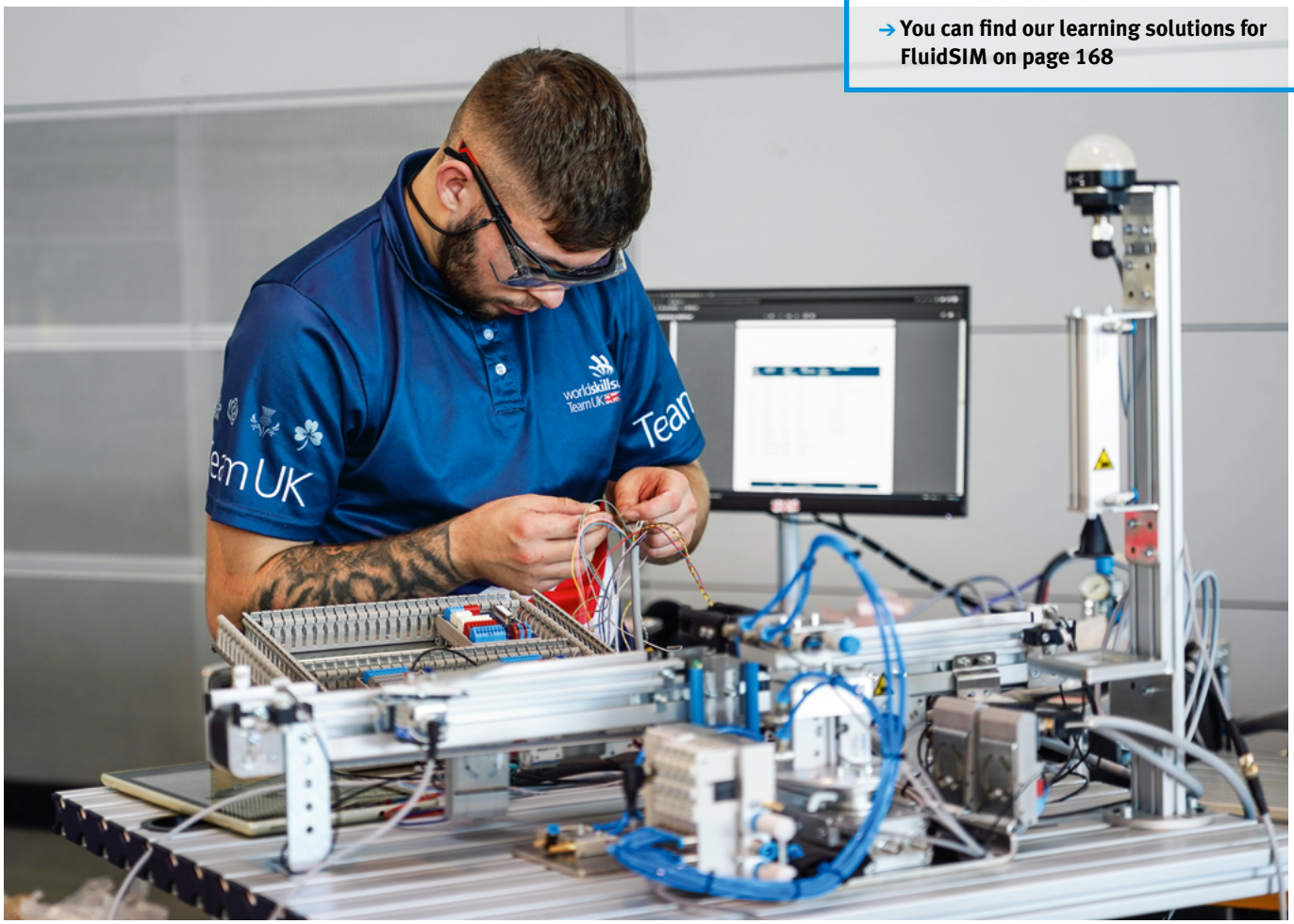
Those who learn are always on the winning side
Festo Didactic develops the official equipment for the sponsored subjects and updates it every year. The young participants perform extremely well in their professions using the state-of-the-art learning systems.

Fluid technology plays an important role in the 04 Mechatronics discipline, but also in the 01 Industrial Mechanics, and 19 Plant Electrical Systems disciplines. Industry-related pneumatic components are installed in a small format automated production systems. The young participants use the FluidSIM simulation software to design virtual electrical systems.

The practical training packages from Festo Didactic provide apprentices with the best possible preparation, whether for professional competitions or for their first job.

→ **You can find our learning solutions on fluid technology from page 23 onwards**

→ **You can find our learning solutions for FluidSIM on page 168**



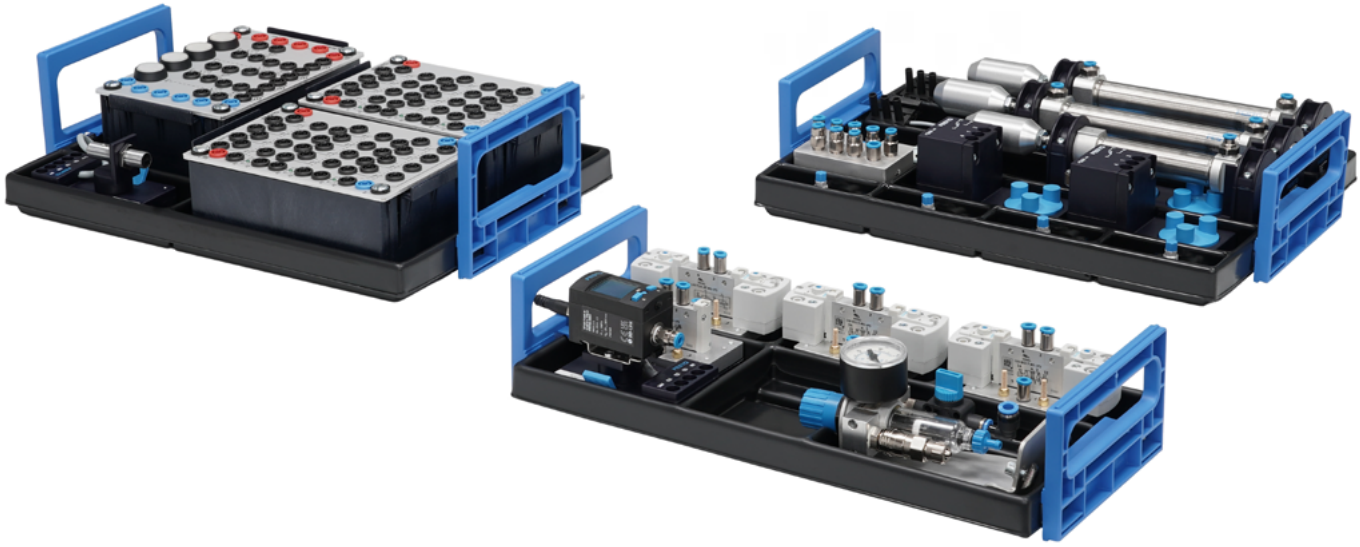
Service
Always There for The Customer

„Our customers can expect efficient and individual solutions from us at all times. This includes fast response times and transparent communication.“

Markus Bellenberg,
Global Technical Customer Service

05

Basic Electropneumatics
Equipment Set TP 201



The most important basics of electropneumatic control technology in compact form

Basic training in electropneumatic control technology is the focus of the Basic Electropneumatics Equipment Set TP 201. Knowledge of the function and use of pneumatic and electrical components is imparted. The focus is on solenoid valves, electronic proximity switches and relay controls, It optimally matches the training media that communicate clear project tasks.

The number and design of the components of the equipment set and the projects of the training media are perfectly coordinated. This allows the important basic principles to be taught with little effort.

Without needing tools and using just one hand, the components can be flexibly arranged on a profile plate with 50 mm slot spacing or in an ER mounting frame to create a wide variety of pneumatic control systems. All pneumatic and electrical connections are located on the top of the components so they are easily accessible.

The pneumatic components are equipped with push-in fittings for plastic tubing with O.D. 4 mm. The electrical components have 4 mm safety sockets. All components are of industrial quality.

The components are supplied in practical equipment trays. The equipment trays not only fit in the drawers of the laboratory furniture but also in a Systainer. Adhesive symbols for clearly labeling where components are stored in the equipment trays are included in the scope of delivery.

Objectives
- Simple electropneumatic controllers
- Design and function of electrical and pneumatic components
- Calculations of basic parameters
- Logical links and latch circuits
- Troubleshooting in simple electropneumatic circuits

Benefits
- Industrial quality components
- The control systems can be assembled virtually without any consumables or tools
- Connection of the solenoid coils via 4 mm safety sockets
- Electrical control unit with relay
- Everything is supplied in an organized equipment tray for systainer and drawer

Service is a top priority
Every customer is individual, and so too is their communication behavior. Festo is fully committed to its customers. You can reach us simply by phone or email. Already at this point, we differentiate between technology and software topics to ensure you get a quick answer. Our ticket system offers the greatest possible transparency in communication and solution finding.

The Didactic InfoPortal provides documentation and specialist product information around the clock.

If you want to stay up to date, subscribe to our newsletter.

For problem solving in real time directly on your system, you can communicate with the experts at Festo via the TeamViewer Quick Support software program. Possible returns can be processed quickly by telephone or by completing a downloadable form.

Whatever your request, Festo is always there for you.

Qualitätsmanagement ISO 9001:2015
www.dekra-siegel.de
DEKRA zertifiziert

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Products


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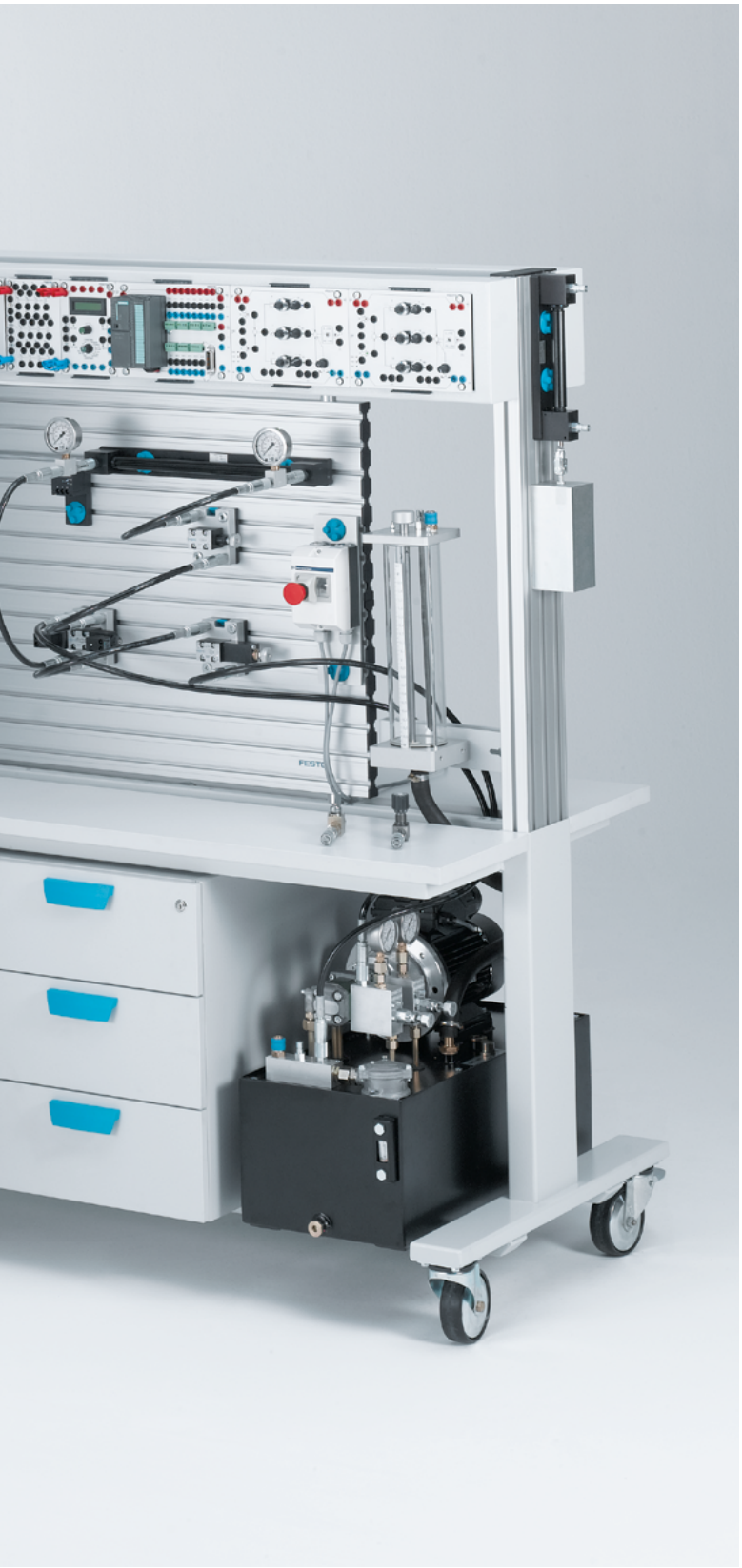
Workstation Systems





Universal Laboratory Furniture

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Stationary Learnline 8
Learnline – Your Individual Design 10
Learntop-A/Learntop-L 14
Learntop-S 16
Frameline 18

Universal Laboratory Furniture
Learnline



The modular workstation systems for education and training, offering many practical details that make teaching and learning easier.

With **Learnline**, you are choosing a consistent organizing principle that can be used for teaching either pneumatic, hydraulic, or electrical engineering and that does not need to be converted. Form and function are perfectly combined, and this is visible in every practical detail. Learnline consists of basic mobile and stationary units with cable/oil trays, various add-on structures and extensions, wheeled and fixed drawer units together with special organizing systems, attachments, and accessories. The modular Learnline workstation system offers a wide range of configurations and add-on options. Expert consultants in over 50 countries can prepare an individual offer for you.

Quality from Festo
We make no compromises when it comes to quality: workmanship and functionality are of the highest standard. The rigid design and the high-quality coating of the work surface and frame guarantee a long service life despite many loads and strains. Learnline can cope with the rigors of everyday teaching, as well as a moving load during hydraulic position control. Learnline easily absorbs high mechanical forces, e.g., from control hydraulics, proportional pneumatics, or robotics add-on top sections.

Versatile, flexible, and expandable
A look at the basic structure proves that Learnline solves a wide range of requirements. Thanks to just a few individual components that have been thought through down to the last detail, results can be achieved that are geared towards people's needs, the available space, and the technical challenges. The functional profile column is a prerequisite for modularity. It is a central attachment point and as such it opens up a wide range of options for putting together the required configuration.

All parts are simply and securely fastened to the profile plate using a T-head nut or the patented Quick-Fix quick fastening system without the need for additional tools.

One fastening system for all technologies and applications.





Organizers
Regardless of whether the training packages are stored in a Systainer or in a drawer unit, the organizers from Festo Didactic always provide a quick overview. The lockable drawer unit has a full extension runner and pull-out stop. Each drawer can carry up to 20 kg. The shipping packaging of the pneumatic and hydraulic equipment sets can be used as a clear drawer insert. This saves material and provides a quick overview of the drawer contents.

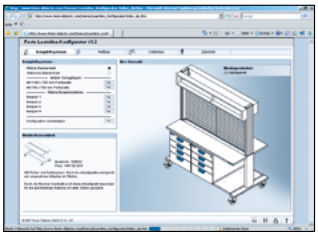


Integrated electrics
The workstations can be used universally with various electrical insert plates, supply channels, and different add-on top sections. The mounting frames are suitable for a large number of exercise boards and ER units. The ER mounting frame is compatible with the electrical components of the training packages. Alternatively, the A4 mounting frame is available, in accordance with the electrotechnical standard.

product design award

Focus Know-how Silber

Benchmark for design and function
Learnline – Winner of international design awards:
– iF Product Design Award
– Focus design award in silver



Learnline online configurator
Get to know the functional design of Learnline and configure workstations on the Internet according to individual requirements. Do you want a predefined sample workstation or your own configuration? Profile plates, drawer units, and accessories are simply selected and added to your configuration. The result is a graphic representation of the selection with a parts list.

Mobile Learnline

More Versatile Than Ever Before!



Flexible and modular
Learnline has a modular structure and offers almost unlimited possibilities for configuring the Learnline workstation system.

High degree of mobility and optimum utilization of space
Areas for individual and group exercise are created where they are needed without any great effort. It can even be maneuvered through doors without any problem. This mobile workstation is designed so that several people can work on it at the same time. This is also made possible by the two integrated fixed drawer units, which provide quick access to the required components of the learning system

Learnline
Winner of international design awards

product design award

Focus Know-how Silber



Perfect use of space
The storage shelf makes great use of the free space next to the fixed drawer units for Systainers or other organizers. The hydraulic power unit with individual pump is conveniently located next to the 1100 mm wide profile plate.



Hydraulics for advanced students
The double pump unit fits perfectly next to the fixed drawer units directly on the base frame, without needing any fastening. In addition to the 1100 mm wide profile plate, there is also space for the discharge measuring receptacle.

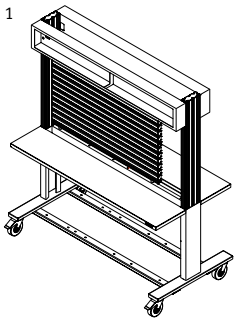


Training in pneumatics and electrical engineering
Up to two compressors fit on the storage plate. In addition to the 700 mm profile plate, additional mounting frames can be used for electrical components, e.g., in A4 format.



Vertical or angled?
The vertical profile plate is useful when using the table surface for workbooks or laptops, for example. Alternatively, you can opt to have an additional profile plate, placed in an inclined position so the station can be used on both sides, with the incline adjustable to suit your needs.

1



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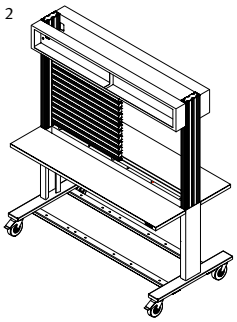

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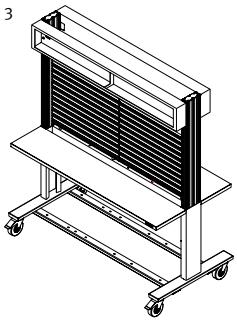

The attractively priced preferred variants. Flexible extension options.
(External dimensions (W x D x H): 1566 x 780 x 1773 mm)

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
The stationary workstation systems of Learnline meet the requirements for typical desk systems while ensuring high functionality at the same time. They provide extensive table space and ample leg room thanks to the wheeled drawer units. The drawer units ensure quick access to the required components.

Vertical or angled?
The tried-and-tested profile plate is securely attached to the stable frame profile. This means that the incline of the profile plate can be infinitely adjusted, up to the horizontal. The exercises can thus always be carried out in an ergonomic position.

Learnline
Winner of international design awards

product design award

Focus Know-how Silber



Conquer the third dimension: profile columns as an add-on surface
Use the versatile profile columns as a setup space, compatible with Quick-Fix, for equipment sets or for attaching additional components vertically. Other components, such as cylinders with a 400 mm stroke, can be attached horizontally to the angled profile.



Perfect use of space
Thanks to the ability to tilt the profile plate, it can be lowered to a horizontal position. The free space can then be used for A4 or ER mounting frames.



Training in pneumatics and electrical engineering
In addition to the 700 mm profile plate, additional mounting frames can be used for electrical components.



Connect ergonomically
The supply duct makes all the important interfaces accessible. 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.

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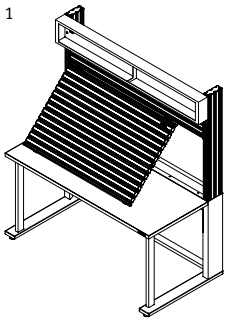

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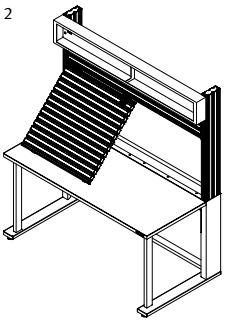

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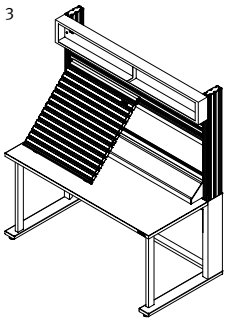

The attractively priced preferred variants. Flexible extension options.
(External dimensions (W x D x H): 1512 x 780 x 1718 mm)

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	Learnline with energy supply channel	On request

Your Individual Design

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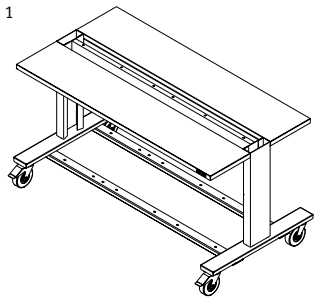

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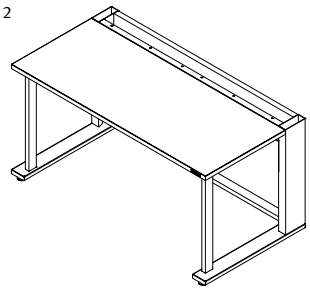

Basic units
Stable and with a high-quality coating, the basic units are guaranteed to meet your high requirements.

1 **Basic mobile unit**
With rollers and wheel brakes. The high worktop enables comfortable working while standing. The flexible design means this workstation is especially suitable for simultaneous use on two sides.
W x D x H: 1556 x 780 x 815 mm.

2 **Basic stationary unit**
The height of the worktop makes it comfortable to work while seated. It can be used for a mounting frame to set up a profile plate. W x D x H: 1512 x 780 x 760 mm.

1 Basic mobile unit	**535832**
2 Basic stationary unit	**535835**

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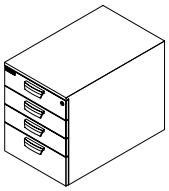

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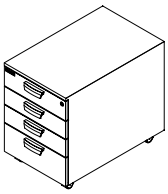

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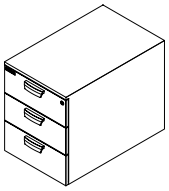

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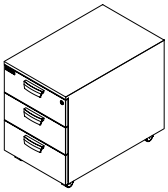

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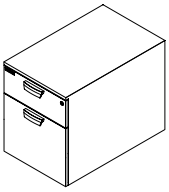

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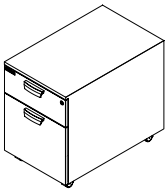

Drawer units

3/4/5 **Fixed drawer unit for mounting in mobile workstations**
Fixed drawer unit with lockable steel drawers with full extension and pull-out stop. Each drawer has a load capacity of up to 20 kg and can be labeled. External dimensions W x D x H: 476 x 788 x 592 mm, usable internal dimensions W x D: 375 x 700 mm

6/7/8 **Wheeled drawer unit for stationary workstations**
Wheeled drawer unit with lockable steel drawers with full extension and pull-out stop. Each drawer has a load capacity of up to 20 kg and can be labeled. External dimensions W x D x H: 476 x 788 x 657 mm, usable internal dimensions W x D: 375 x 700 mm. All wheels can be moved freely, two wheels have a parking 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 frames/mounting sets
Versatile profile columns are the core of the Learnline structure. They are used to attach the profile plate support, to mount components, or to provide an alternative mounting surface for your training components.

1 **For vertical profile plate mounting**
The profile plate support is mounted between the profile columns, the profile plate is firmly screwed to the mounting frame and the frame construction. The workstation is thus extremely strong and resilient, and the profile plate can be used on both sides.

2 **For adjustable, inclined profile plate mounting**
The profile plate holder can be mounted at any height on the two profile columns, allowing you to customize the workplace ergonomics to your needs. You also have the option of attaching the components from the training package directly to the mounting frame, which will give you additional work space

3 **Mounting frame for A4 mounting**
A4 mountings are mounted between the profile columns. Up to three rows of A4 mountings can be attached using two additional mounting sets.

In order to mount the profile plates, order one mounting set per profile plate. For mounting A4 units, order one mounting set for each additional row.

1	Mounting frame for vertical profile plate mounting	**540698**
	Mounting set for vertical profile plate mounting	**540697**
2	Mounting frame for inclined profile plate mounting	**539032**
	Mounting set for inclined profile plate mounting	**539735**
3	Mounting frame for A4 mounting	**8066141**
	Mounting set for A4 mounting	**8065498**

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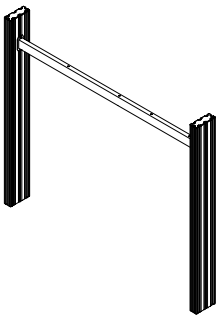

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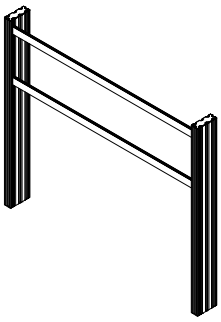

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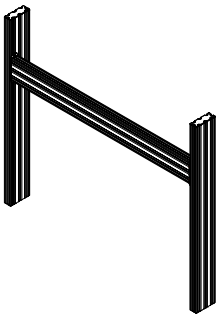

4/5 **Aluminum profile plates**
The basis for the components of all training packages is the anodized aluminum profile plate. The slots on the front and back of the plate allow it to be used on both sides, if necessary. The slots are compatible with the ITEM profile system, grid dimension 50 mm. The components can be securely fastened in them.

We recommend using the relevant rubber feet (order no. 158343) when installing the plates on a table.

	700 x 550 mm	**159409**
4	700 x 700 mm	**159410**
5	700 x 1100 mm	**159411**

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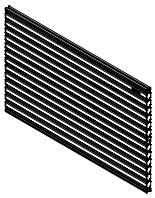

Your Individual Design

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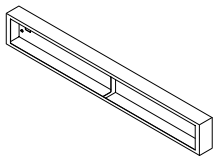

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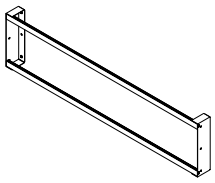

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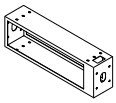

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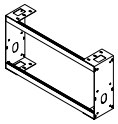

ER and A4 mounting frames
The mounting frames of the workstations can be used for a large number of exercise boards and ER units of the automation technology learning system. This compatibility also applies to the electrical engineering equipment in A4 format. This provides ample choice to create a satisfactory solution for almost any specific exercise.

1/3 **Mounting frame (1500 mm wide)**
The height of the ER mounting frame mounted on the profile column can be adjusted and holds up to 12 ER/6 A4 units. A mounting frame can be attached to each side of the mobile workstation.

2/4 **Mounting frame (700 mm wide)**
The small ER mounting frame allows you to use ER/A4 components directly to the left or right of a 700 mm wide profile plate.

1 ER mounting frame (1500 mm wide)	**539022**
2 ER mounting frame (700 mm wide)	**539033**
3 A4 mounting frame (1500 mm wide)	**539021**
4 A4 mounting frame (700 mm wide)	**539755**

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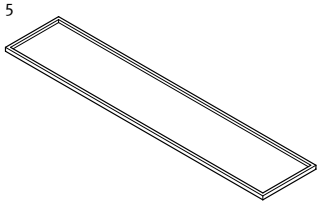

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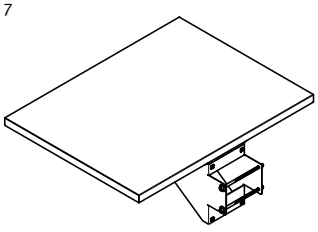

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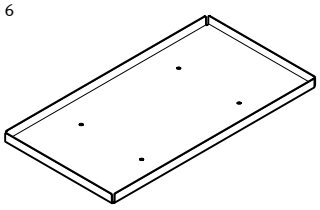

5 **Oil spillage/protective mat**
Black, with rubber rim. Protects the Learnline table top and keeps it clean

312 x 1512 mm	**541133**

6 **Storage plate**
Fits, in addition to two drawer units, in the mobile base frame and offers storage space for two compressors (order no. 91030). W x D x H: 748 x 403 x 30 mm.

Order no.	**539729**

7 **Table extension**
For easy mounting to the profile column support of a mobile workstation. The table height can be adjusted between 700 and 815 mm. Table surface dimensions W x D: 780 x 600 mm

Order no.	**566435**

Accessories

1 **Universal bracket**
Enables the mounting of up to two hydraulic power packs with a single pump or up to two hydraulic discharge measuring receptacles or tubing holders. W x D x H: 50 x 275 x 130 mm.
Order no. **539736**

2 **Tubing holder**
For up to 20 hydraulic tubes. Keeps the couplings tidy and protects them from dirt. W x D x H: 366 x 182 x 80 mm.
Order no. **539737**

3 **Cable guide**
For one set of electrical laboratory cables. Ensures neatness and order. W x D x H: 150 x 136 x 63 mm.
Order no. **535812**

4 **Monitor mounting bracket, short**
Monitor mounting bracket for TFT and LCD monitors with drilled holes according to the VESA standard (75 x 75 mm or 100 x 100 mm hole spacing).
– Short articulated arm for minimum distance to the mounting surface (approx. 80 mm)
– For mounting on the Learnline mounting frame or on a wall
– Pivots up to 180°, tilts up to 45°
– Complete with mounting materials
– Maximum load capacity: 23 kg
Order no. **556292**

5 **Monitor mounting bracket, long**
Monitor mounting bracket for TFT and LCD monitors with drilled holes according to the VESA standard (75 x 75 mm or 100 x 100 mm hole spacing)
– Long telescopic articulated arm for large swivel angle
– Distance to the mounting surface (approx. 80 - 380 mm)
– For mounting on the Learnline mounting frame or on a wall
– Pivots up to 180°, tilts up to 45°
– Complete with mounting materials
– Maximum load capacity: 15 kg
Order no. **556293**

6/7/8 **Protective grounding for laboratory furniture**
The products are used as protective grounding for laboratory furniture as per the VDE 0100 standard. This is achieved by connecting touchable, conductive parts with equipotential bonding conductors to each other and connecting them to the protective conductor of the power supply.

6 **Grounding set**
A grounding set is required for connecting all conductive parts of one to two pieces of laboratory furniture. The connector for the PE conductor of the power supply is included.
Order no. **8049368**

7 **Connector set**
A connector set is required for connecting laboratory furniture to the PE conductor of the power supply.
Order no. **8049447**

8 **Barbed T-connector for PE conductor**
A barbed T-connector lets you combine up to three PE conductors for connection to the power supply.
Order no. **8049442**

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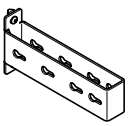

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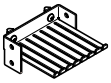

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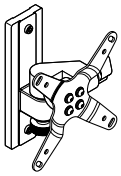

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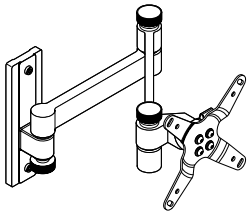

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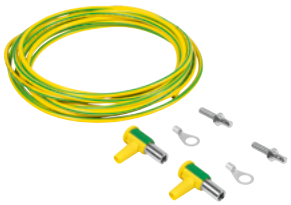

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Learntop-A/Learntop-L

The Low-Cost Desktop Mounting System

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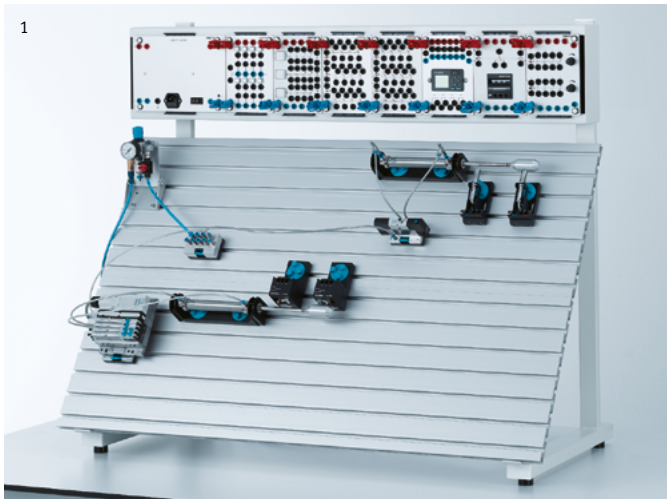

2



The affordable introduction to the world of training packages from Festo Didactic. Make the most of the advantages that the profile plate and the ER mounting frame can offer for your pneumatics, sensor, or PLC training. The equipment can be clearly arranged and enable work on the existing work tables and workbenches to be carried out ergonomically.

Mounting materials for fitting the profile plates and assembly instructions are included in the scope of delivery. The screw fitting with the work table is recommended for safety reasons.

1 **Learntop-A**
An equipment carrier that can be used on one side. The components are ergonomically positioned thanks to the angled profile plate. Not suitable for hydraulics training.

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

Supplied without profile plates.

Order no.	**540670**

2 **Learntop-L**
Equipment carrier that can be used on one side, for profile plates sized 700 x 1100 mm (order no. 159411). For horizontal placement of the profile plate. Not suitable for hydraulics training.

Supplied without profile plates.

Order no.	**540669**

Learntop-A/Learntop-L
Accessories

1 **Aluminum profile plate**
The basis for the components of all training packages is the anodized aluminum profile plate. The slots on the front and back of the plate allow it to be used on both sides, if necessary. The slots are compatible with the ITEM profile system, grid dimension 50 mm. The components can be securely fastened in them.

We recommend using the relevant rubber feet (order no. 158343) when installing the plates on a table.

The 350 x 1100 mm size is supplied without side cover caps (H x W)

350 x 1100 mm	**162360**
700 x 1100 mm	**159411**

2 **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 as a protective measure. Similar to the illustration!

Learnline, vertical profile plate

Order no.	**533528**

Horizontal profile plate (e.g., Learntop-L)

Order no.	**119352**

3 **Slotted mounting plate**
All components with the Quick-Fix quick fastening system can be attached to the slotted mounting plates. The slotted mounting plates with elastic buffers can be used lying on a table. Order no. 159331 can also be inserted into conventional A4 mounting frames. The slotted mounting plates are not suitable for use with actuators.
(External dimensions: H x W in each case)

694 x 297 mm	**159331**
700 x 550 mm	**544246**

4 **Rubber feet**
For non-slip and gentle placement of aluminum profile plates on any table surface. Set (4 pieces).

Order no.	**158343**

5 **Plug-in adapter set**
With the plug-in adapter set, the ER units can be attached directly to the blue plug-in panel or to the aluminum profile plate. One set is required to attach each unit

Order no.	**541122**

6 **A4 ER mounting frame**
The ER mounting plate can be hooked into any A4 mounting frame. A recess allows the mounting of 2 large or 4 small Festo Didactic ER units (H x W)

297 x 500 mm	**536200**

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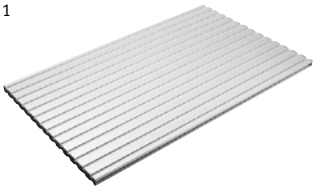

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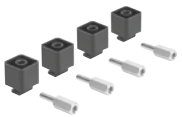

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Learntop-S

The Low-Cost Desktop Mounting System

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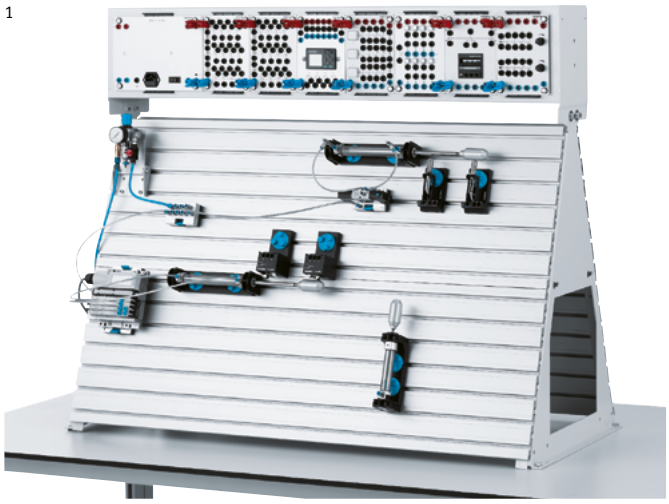


2



1+2



The affordable introduction to the world of training packages from Festo Didactic. Make the most of the advantages that the profile plate and the ER mounting frame can offer for your pneumatics, sensor, or PLC training. The equipment can be clearly arranged and enable work on the existing work tables and workbenches to be carried out ergonomically.

Mounting materials for fitting the profile plates and assembly instructions are included in the scope of delivery. The screw fitting with the work table is recommended for safety reasons.

1 **Learntop-S**
The flexible equipment carrier for all technologies, with ER mounting frame.
– Mobile: Can simply be set up on an existing work table or workbench.
– Versatile: Can be used on both sides.
– Ergonomic: The angled profile plate allows the components to be clearly arranged.
– Dimensions (W x D x H): 1110 x 525 x 980 mm

Supports 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).

Supports up to 2 profile plates of size 350 x 1100 mm (order no. 162360) and 2 slotted mounting plates (order no. 8062676) for Learntop-S for Quick-Fix clamping piece mounting, one of them on each side

Supplied without profile plates.

Order no.	**8062672**

2 **Mobile worktable for Learntop-S**
– Drawer unit with 8 fully extending drawers, load per drawer up to 20 kg
– Storage space with lockable sliding doors
– Tubular steel table top
– Dimensions (W x D x H): 1118 x 778 x 920 mm
– Table height: 920 mm

Order no.	**8062673**

Learntop-S
Accessories

1 **Aluminum profile plate**
The basis for the components of all training packages is the anodized aluminum profile plate. The slots on the front and back of the plate allow it to be used on both sides, if necessary. The slots are compatible with the ITEM profile system, grid dimension 50 mm. The components can be securely fastened in them.

We recommend using the relevant rubber feet (order no. 158343) when installing the plates on a table.

The 350 x 1100 mm size is supplied without side cover caps (H x W)

350 x 1100 mm	**162360**
700 x 1100 mm	**159411**

2 **Perforated work surface**
For Lab-Volt series pneumatic/hydraulic learning system, 700 x 1100 mm for Learntop-S (only compatible with Learntop-S)

Order no.	**8062675**

3 **Slotted mounting plate**
For installing Quick-Fix clamping pieces, must be used together with an aluminum profile plate 350 x 1100 mm (order no. 162360) so that Quick-Fix screw connection components can also be attached (only compatible with Learntop-S order no. 8062672).

Order no.	**8062676**

4 **Cable guide**
For one set of electrical laboratory cables. Ensures neatness and order. W x D x H: 150 x 136 x 63 mm.

Order no.	**535812**

5 **Tubing holder**
For up to 20 hydraulic tubes. Keeps the couplings tidy and protects them from dirt.
W x D x H: 366 x 182 x 80 mm.

Order no.	**539737**

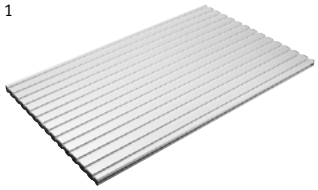
6 **Steel tub base for Learntop-S**

Order no.	**8062674**

7 **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 as a protective measure

Learntop-S, inclined profile plate

Order no.	**526847**

1


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Frameline

Your Individual Design

1


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7


1 **Frameline mobile, basic model 230 V**
Mobile Frameline basic frame with energy duct for individual lab and workshop design. Back-to-back positioning is possible, as well as compact, space-saving storage of 3 frames in a row to one meter deep. Compact design for extremely short setup times.
– Dimensions (W x D x H):
1505 x 700 x 830 – 1295 mm
Order no. **8075129**

2 **Frameline mobile, basic model 400 V**
Mobile Frameline basic frame with energy duct for individual lab and workshop design. Back-to-back positioning is possible, as well as compact, space-saving storage of 3 frames in a row to one meter deep. Compact design for extremely short setup times.
– Dimensions (W x D x H):
1505 x 700 x 830 – 1295 mm
Order no. **8075130**

3 **Frameline mobile, complete model 230 V**
Mobile Frameline basic frame with energy duct and setup with two A4 rows and one ER row for individual lab and workshop design. Back-to-back positioning is possible, as well as compact, space-saving storage of 3 frames in a row to one meter deep. Compact design for extremely short setup times.
– Dimensions (W x D x H):
1505 x 700 x 1953 – 2073 mm
Order no. **8075131**

4 **Frameline mobile, complete model 400 V**
Mobile Frameline basic frame with energy duct and setup with two A4 rows and one ER row for individual lab and workshop design. Back-to-back positioning is possible, as well as compact, space-saving storage of 3 frames in a row to one meter deep. Compact design for extremely short setup times.
– Dimensions (W x D x H):
1505 x 700 x 1953 – 2073 mm
Order no. **8075132**

5 **Frameline mobile, complete model without energy duct**
Mobile Frameline basic frame and setup with two DIN A4 lines and one ER line for individual lab and workshop design. Back-to-back positioning is possible, as well as compact, space-saving storage of 3 frames in a row to one meter deep. Compact design for extremely short setup times.
– Dimensions (W x D x H):
1505 x 700 x 1953 – 2073 mm
Order no. **8075133**

6 **Frameline mobile table**
– Dimensions (W x D x H): 1500 x 700 x 780 mm, with four swivel castors, two with parking brakes
– Table with four legs as per DIN EN 1729, stable, welded design with light gray frame and legs made from precision profile steel tubing
– Table made from 25 mm, three-ply, quality chipboard, melamine resin coating in light gray, and additional overlay edges, with 3 mm ABS edge band, uniformly sealed
– Table legs offset inwards for adaptation to the Frameline mobile
Order no. **8087149**

7 **Frameline mobile folding table**
– Dimensions (W x D x H): 1500 x 700 x 750 mm, with four swivel castors, two with parking brakes
– Table with four legs as per DIN EN 1729, stable, welded design with light gray frame and legs made from precision profile steel tubing
– Maximum payload: 150 kg
– Folding table for space-saving storage
– Table with HPL coating
Order no. **8087150**

1 **Frameline mobile lab table**
– Dimensions (W x D x H): 1500 x 750 x 750 mm, with 4 swivel castors, two with parking brakes
– Stable, four-leg, welded design with additional bottom tray for storage
– Maximum payload: 250 kg
– Table legs offset inwards for adaptation to the Frameline mobile

Order no. **8087152**

2 **Frameline trolley with pull-outs for TPs pneumatics**
– Dimensions (W x D x H): 810 x 800 x 869 mm, frame with four swivel castors, two with parking brakes
– Three fully extending drawers for storing Festo Didactic TPs with components. The equipment trays are arranged horizontally at a depth of 375 mm, leaving sufficient storage space for small parts behind them (W x D) 700 x 300 mm. Above the drawers there is storage space for a profile plate.

Order no. **8087155**

3 **Frameline trolley for profile plates, 700 mm**
– On the inside, left and right, there are eight blue brackets with a brush strip where eight profile plates 700 x 700 mm (order no. 159410), including profile plate adaptation, can be easily and conveniently stored.
– Two hinged doors with 270° fittings, blue handles, and locking system
– Dimensions (W x D x H): 810 x 800 x 869 mm

Order no. **8087153**

4 **Frameline trolley for A4 plates**
– Inside shelf, (W x D) 770 x 760 mm, with slotted mat at top and bottom, providing two compartments for storing A4 plates
– Two hinged doors with 270° fittings, blue handles, and locking system

Order no. **8087154**

5 **Frameline trolley for motor test bench**
– Inside shelf, (W x D) 770 x 760 mm, with slotted mat at top and bottom providing two compartments: above for storing A4 plates, and below for storing motors and accessories
– Two hinged doors with 270° fittings, blue handles, and locking system

Order no. **8087156**

6 **Frameline keyboard shelf**
For placing a computer keyboard and mouse. Swivels to the side, if required.
– Load bearing capacity 10 kg
– Storage area 640 x 172 mm
– Swing arm length 589 mm
– Swivel angle 180°
– Tilt 45°

Order no. **8087159**

7 **Frameline monitor mounting bracket**
Monitor folding arm, approx. length 455 mm, including fall protection, max. weight 5 kg, infinitely adjustable in all directions.

Order no. **8087157**

8 **Frameline profile plate 700 x 700 mm, removable**
– Slots in 50 mm grid dimension for mounting Quick-Fix components
– Suspension (metal rod with insertable adapter) for profile plate. If required, the profile plates are available in the Frameline trolley.

Order no. **8087160**

9 **Cable guide**
For one set of electrical laboratory cables. Ensures neatness and order. W x D x H: 150 x 136 x 63 mm.

Order no. **535812**

10 **Frameline PC retaining bracket**
Frameline CPU retainer for mini-PCs for mounting in the Frameline cable tray, maximum dimensions PC 360 x 175 x 417 mm.

Order no. **8087158**

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Pneumatics and Hydraulics Training Packages





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The Educational Concept for Full Competence

Our Training Concept for the Training Packages

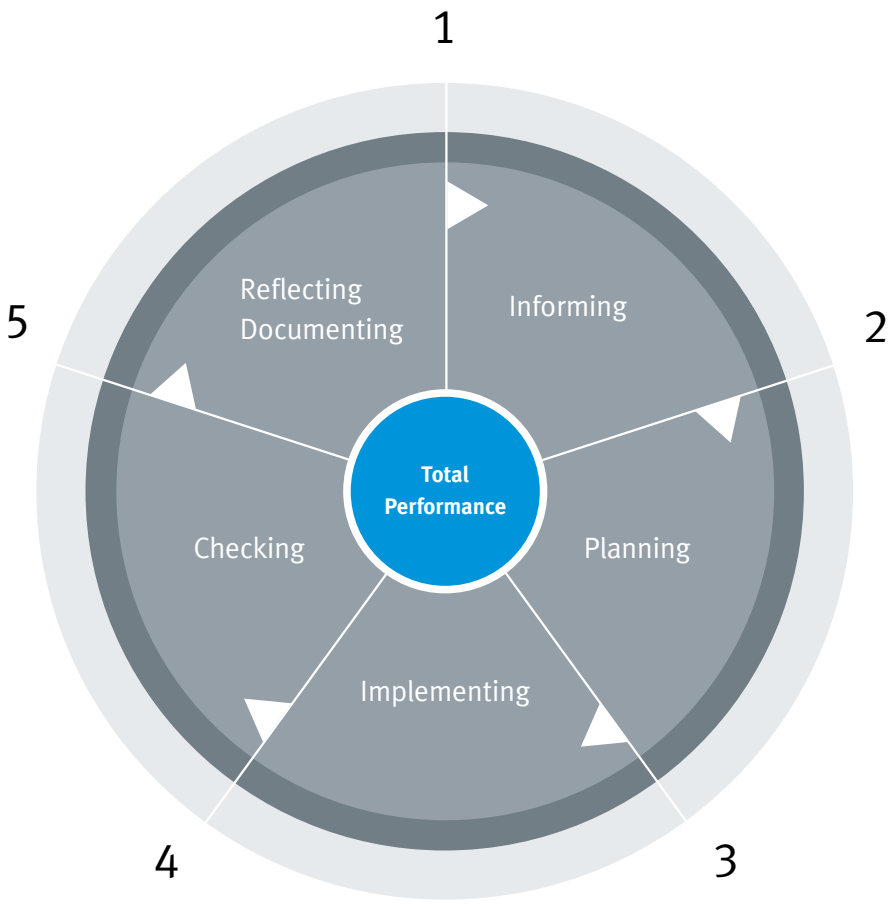
1 Informing
– Read the problem description in the **workbook**
– Understand the assignment
– Acquire missing knowledge

2 Planning
– Design a circuit with **FluidSIM®**
– Generate a circuit diagram with a bill of materials

3 Implementing
– Design and commission the circuit on a **workstation system** with the **training packages**
– Simplified, accessible, and convenient

4 Checking
– Comparing the target and actual state and targeted troubleshooting, e.g., using measuring technology **components**

5 Reflecting, documenting
– Evaluating the result, optimizing, and documenting professionally using the worksheets in the **workbook** and **FluidSIM** CAD drawings



We offer technical training based on the educational concept for full competence

Educational and training institutions are facing the challenge of providing the graduates the local economy is looking for. Companies want well-trained, responsible, and highly skilled employees.

The Festo Didactic training packages are tailor-made to meet this objective.

Pneumatics/Hydraulics
Components of a Learning System



The benefits of the Festo Didactic modular learning system

Design your own learning environment in line with your educational, organizational, and ergonomic requirements.

Save time by using the coordinated learning system, consisting of training packages, workbooks as course material and the matching design and simulation tool FluidSIM.

You can add other components to your selected system for your own individual exercises or project ideas.

Media
– FluidSIM
– FluidLab
– Courseware
– Festo LX digital learning portal

Workstation systems
– Profile plate for pneumatics, hydraulics, and sensors
– ER frame for control and regulation
– Drawer unit with a clear layout for storing pneumatic components

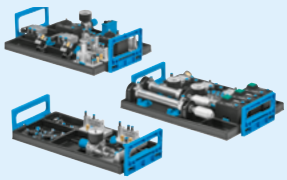
Training packages
– For pneumatics, hydraulics, and sensors
– For basic level, advanced level, and supplementary equipment sets

Components/accessories
– As add-ons or for personalization

Pneumatics Training Packages

Overview and Structure

Pneumatics for Beginners



Pneumatics Basic Level
TP 101
TP 101 America

Electropneumatics Basic Level
TP 201
TP 201 America

Sensors for Object Detection
TP 1311

Pneumatics for Advanced Users



Pneumatics Advanced Level
TP 102
TP 101/TP 101 America is required

Systematic Troubleshooting
TP 101+
TP 101/TP 101 America is required

Electropneumatics Advanced Level
TP 202
TP 201/TP 201 America is required

PLC integration into pneumatic systems
TP 203
TP 201/TP 201 America is required

Measurement and Control in Pneumatics
TP 210
TP 201/TP 201 America is required

Drives in Pneumatics
TP 220
TP 201/TP 201 America is required

Vacuum Technology
TP 230
TP 201/TP 201 America is required

Sensors in Pneumatics
TP 240
TP 201/TP 201 America is required

Safety in Pneumatic Systems
TP 250
TP 201/TP 201 America is required

Digitalization in Pneumatics
TP 260
TP 201/TP 201 America is required

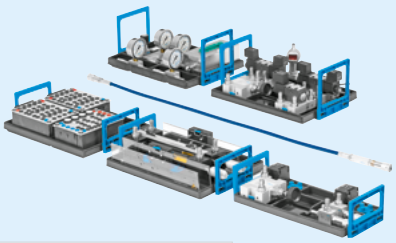
Programmable Logic Controllers
TP 301

Closed-Loop Pneumatics Basic Level
TP 111

Energy-Efficient Compressed Air Management
Air Control System AirCS Equipment Set

Hydraulics Training Packages
Overview and Structure

Hydraulics for Beginners



Hydraulics Basic Level
TP 501
TP 501 America

Electrohydraulics Basic Level
TP 601
TP 601 America

Hydraulics for Advanced Users



Hydraulics Advanced Level
TP 502
TP 501 is required

Systematic Troubleshooting
TP 501+
TP 501 is required

Electrohydraulics Advanced Level
TP 602
TP 601 is required

Measurement and Control in Hydraulics
TP 610
TP 601 is required

Digitalization in Hydraulics
TP 660
TP 601 is required

Proportional Hydraulics Basic Level
TP 701

Proportional Hydraulics Advanced Level
TP 702
TP 701 is required

Basics of Closed-Loop Hydraulics
TP 511

Mobile Hydraulics Basic Level – Working Hydraulics 1
TP 801

Mobile Hydraulics Advanced Level – Hydrostatic Steering System
TP 802

Mobile Hydraulics Advanced Level – Working Hydraulics 2
TP 803

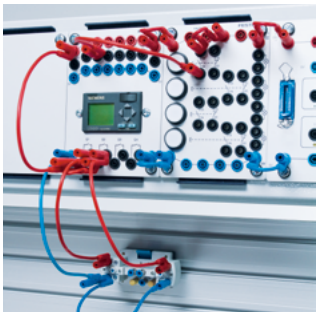
Diagnostic System FluidLab-M – Advanced Level
TP 810

Pneumatics Training Packages

Innovative and Practical down to the Last Detail



Modular, flexible, and expandable
The training packages from Festo Didactic have a modular structure. For example, you could start with the basic level of electropneumatics and then move onto the advanced level. Or you could begin with electrohydraulics. The choice is yours. Want to train on a specific group of topics? All the equipment set components of our training packages can also be ordered separately, so you can turn your own ideas into reality.



Position – clamp – done!
With the Quick-Fix quick fastening system, all components are simply and securely attached to the profile plate and profile column of a Learnline workstation. The electrical units are clamped into the ER frame and lined up individually. The profile slots of the workstations are the same for all pneumatic, hydraulic, and electrical units – invest once, use twice.



Keep a clear and systematic overview!
Most equipment sets are supplied with a Systainer-compatible organizer. This organizer fits into the drawers of the workstations. The large symbol label on the components, designed in accordance with the current standard, provides an overview for the correct connection of the components, and ensures short preparation and follow-up times. When dismantling the circuit, the component is quickly and reliably located in the organizer.



Plug in – Connect – Power!
We make no compromises when it comes to safety: all electrical components and units are connected using 4 mm safety sockets or safety plugs. The pneumatic power supply is provided by connecting highly flexible plastic tubing to the push-in fitting QS. This means that the system requires virtually no consumables or tools.



Didactic plus

The workbooks accompanying the training packages contain project-related exercises of increasing complexity. There are also layout sketches, illustrations, videos, cross-sectional drawings, and animations that show how everything looks in practice. To ensure the topic of pneumatics is covered fully and expertly, the training also covers basic physics, technical calculations, safety, efficiency, analytical fault finding and professional documentation.

Practical education and training using industrial components instils the confidence to apply the acquired knowledge in the workplace. The components are specially selected for the exercises in the workbook. By the way, almost all pneumatic and electrical connections are on the top of the components so they are easily accessible.





Your choice of training environment
User-friendly training environments for specific topic areas:
– Self-study phases with the learning programs
– Design and documentation with FluidSIM
– Practical implementation with the training packages and the exercises in the workbooks
– Functional testing and optimization using measurement technology and FluidLab



Advanced courses made easy
New developments and trends in fluid technology are included into our learning systems straightaway. With the EduTrainer concept, new controls can be integrated into the learning system. Basic packages can easily be expanded to include the topics "Measurement and Control in Pneumatics TP 210" or the new "Vacuum Technology TP 230".



TP 230 Vacuum Technology
Handling workpieces with suction grippers has become an integral part of handling technology. It offers advantages such as the simple design of suction grippers and gentle workpiece handling. In addition, fast cycle times are possible and the investment costs are comparatively low. The training package TP 230 with its focus on vacuum technology extends the learning content of TP 201.



TP 250 Safety in Pneumatic Systems
Function, efficiency and, above all, safety determine the success of machines and systems. New directives and laws require intelligent solutions and raise the level of professional skills required. The systematic optimization of a simple pneumatic system helps to identify hazards in pneumatic processes. The appropriate risk reduction measures can then be implemented professionally.

Learning Path Digitalization



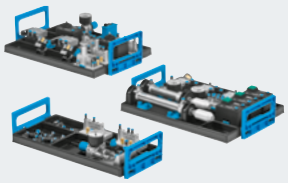
Basic Technology

Electrical Control of Pneumatic Systems

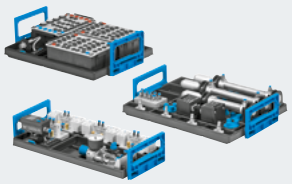
Beginner Level

– No experience in automation

Basics of Pneumatics
TP 101



Electropneumatics
TP 201
+ TP 202



What is a learning path?
A learning path is a structured sequence of learning activities that guides students step by step on their journey to acquire new skills. Learning paths include different types of learning solutions such as digital courses, videos, hands-on training, and user manuals.
The structured learning path ensures progress is systematic since it enables students to acquire knowledge efficiently and master the essential aspects of a topic or skill by building on previously acquired understanding.
Adapting a learning path based on students' progress and feedback makes for a dynamic and targeted learning experience.

Digitalized Automation
In the age of digitalization, automation solutions are implemented using programmable logic controllers (PLC). A basic knowledge and understanding of PLCs is the minimum requirement for the maintenance and troubleshooting of these systems.
We offer you the appropriate and complete solution for the basics of digitized automation so that you are optimally prepared for the requirements of modern industry.

Learning path ‚Digitalization'
No initial experience with pneumatics? You can start the path from the very beginning.
Already familiar with the basics of pneumatics and electropneumatics? Now is the perfect time to take your training to the next level with the advanced TP packages TP 202, TP 203, and TP 260. Designed to deepen your practical knowledge and prepare you for modern automation and digitalization.

PLC Integration in Pneumatics

Smart Maintenance / Digitalization



PLC Programming
TP 203



Digitalization in Pneumatics
TP 260



Expert level

– Think like operators
– Act like technicians
– Solve like professionals

Beginning of the path (before training)
– No prior experience in automation
– Manual focus, paper-based processes
– Traditional mindset
– Entry-level knowledge
– Not yet connected
– Exploring digitalization
– Foundational stage

Completion of the path (after training)
– Confident handling of automation systems
– Data-driven and digitally supported workflows
– Digital mindset and adaptability
– Advanced technical competence
– Integrated and networked systems
– Applying digital tools effectively
– Industry-ready skills for smart factories

Recommended learning materials

Workbooks
– Pneumatics Basic Level
– Electropneumatics Basic Level
– Programmable Logic Controllers Basic Level
– Digitalization in Pneumatics Basic Level

eLearning courses on pneumatics
→ Basic Principles of Pneumatics
→ Simple Pneumatic Circuits
→ Pneumatic Actuators
→ Pneumatic Valves
→ Pneumatic Air Treatment

eLab course on pneumatics
→ Basics of Pneumatics

Pneumatics evaluation
→ Basics of Pneumatics

eLearning courses on electropneumatics
→ Basic Principles of Electropneumatics
→ Basic Electropneumatic Circuits
→ Electropneumatic Components

eLab course on electropneumatics
→ Basics of Electropneumatics

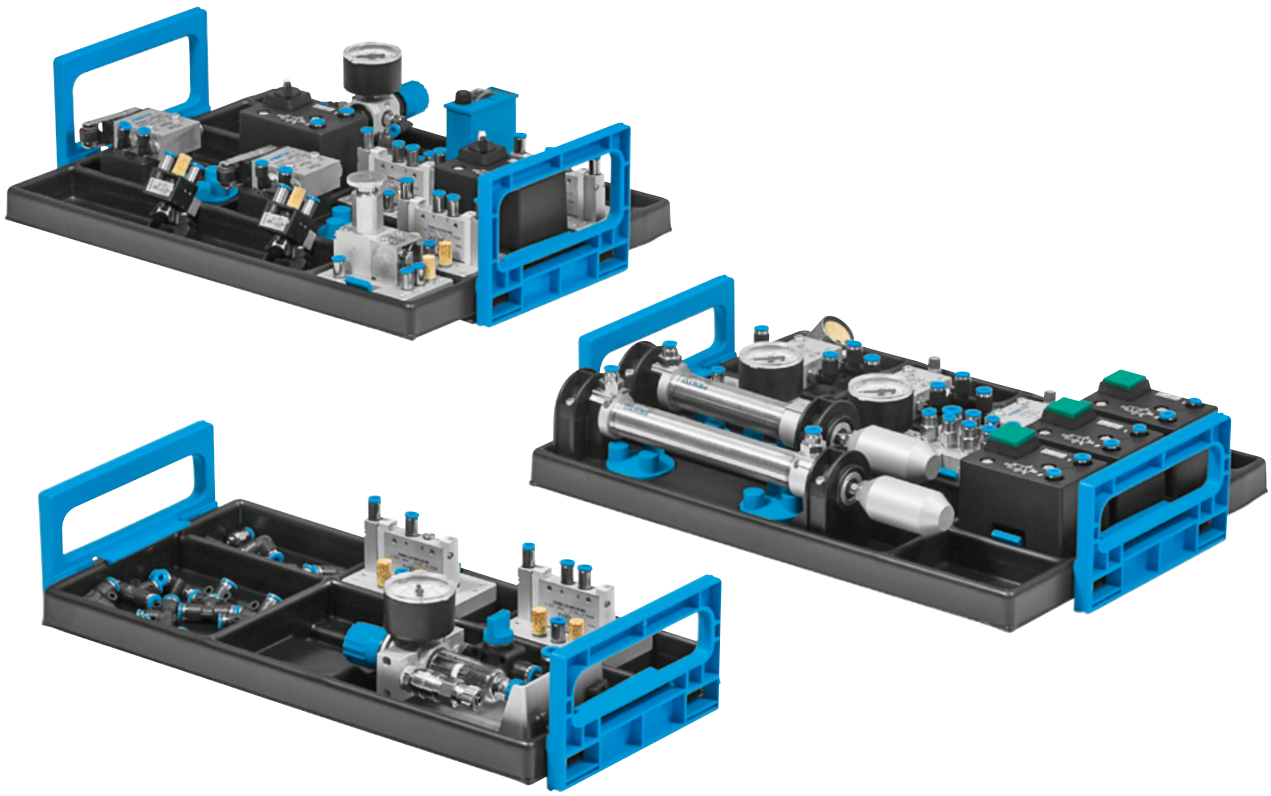
Evaluation – Electropneumatics
→ Basics of Electropneumatics

eLearning course
→ Basics of PLC Programming

eLab course on digitalization
→ Digitalization in Pneumatics

Evaluation
→ Basics of PLC Programming

Pneumatics Basic Level
Equipment Set TP 101



The classic – based on experience from more than thousand pneumatics courses

The Pneumatics Basic Level Equipment Set TP 101 focuses on the basics for training in pneumatic control technology, It provides an understanding of the basic physical principles of pneumatics, as well as how pneumatic components work and are used. It optimally matches the training media that communicate clear project tasks.

The number and design of the components of the equipment set and the projects of the training media are perfectly coordinated. This allows the important basic principles to be taught with little effort.

Without needing tools and using just one hand, the components can be flexibly arranged on a profile plate with 50 mm slot spacing to create a wide variety of pneumatic control systems. All pneumatic connections are on the top of the components so they are easily accessible. The pneumatic components are equipped with push-in fittings for plastic tubing with O.D. 4 mm. All components are of industrial quality.

The components are supplied in practical equipment trays. The equipment trays not only fit in the drawers of the laboratory furniture but also in a Systainer. Adhesive symbols for clearly labeling where components are stored in the equipment trays are included in the scope of delivery.

Objectives
- Simple pneumatic control systems
- Control technology fundamentals and terminology
- Structure and function of pneumatic components
- Logical links and latch circuits
- Sequence descriptions with GRAFCET

Benefits
- With brand new industrial components
- The control systems can be assembled virtually without any consumables or tools
- Components are placed simply and securely with the Quick-Fix quick fastening system
- Pneumatic connections are on top of the components and easily accessible
- Everything is supplied in an organized equipment tray for systainer and drawer

Complete Equipment Set TP 101 in organizer	**540710**

The most important components at a glance:

2x	3/2-way valve with pushbutton actuator, normally closed	152860
1x	3/2-way valve with pushbutton actuator, normally open	152861
1x	5/2-way panel mounted valve with selector switch	152862
1x	3/2-way panel mounted valve with selector switch, normally closed	152863
2x	3/2-way roller lever valve, normally closed	152866
2x	Proximity switch, pneumatic, with cylinder mounting	2764815
1x	Pneumatic timer, normally closed	540694
1x	Pressure sequence valve	152884
1x	3/2-way valve, pneumatically actuated at one side	576302
1x	5/2-way valve, pneumatically actuated at one side	576307
3x	5/2-way double pilot valve, pneumatically actuated at both sides	576303
1x	Shuttle valve (OR)	539771
2x	AND valve	539770
1x	Quick-exhaust valve	539772
2x	One-way flow control valve	193967
1x	Single-acting cylinder	152887
1x	Double-acting cylinder	152888
1x	Start-up valve with filter control valve	540691
1x	Pressure regulator valve with pressure gauge	539756
2x	Pressure gauge	152865
1x	Manifold	152896
2x	Plastic tubing, 4 x 0.75 silver 10 m	151496

Accessories, order at the same time:

Aluminum profile plate → Page 11, 17
Compressor → Page 132

Recommended learning materials

Workbook



Campus license (→ Page 167)

de	540671
en	541088
es	542503
fr	542507

eLearning courses

→ Basic Principles of Pneumatics



→ Simple Pneumatic Circuits
→ Pneumatic Actuators
→ Pneumatic Valves
→ Pneumatic Air Treatment

eLab course

→ Basics of Pneumatics



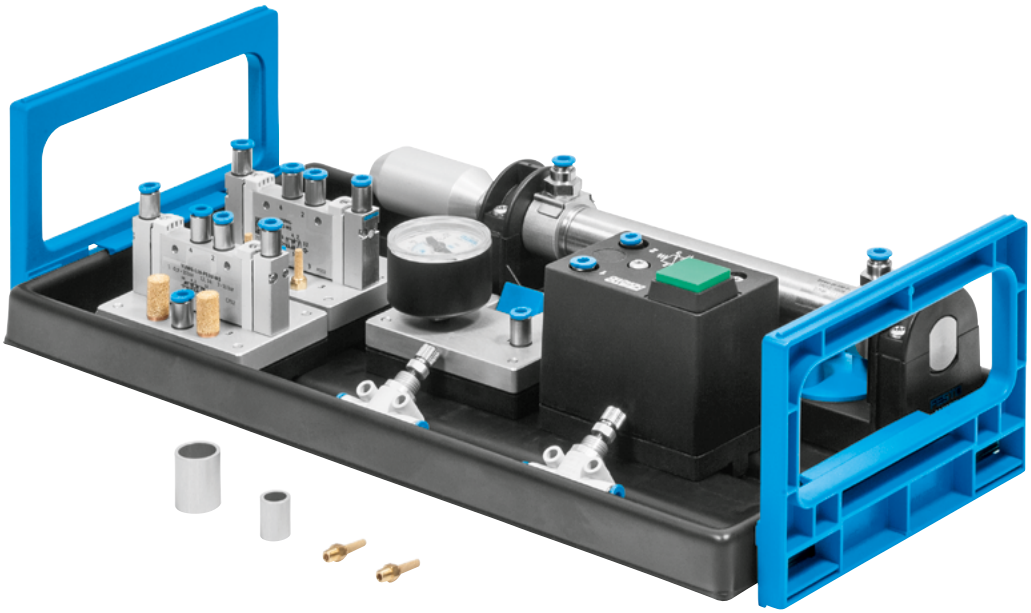
Evaluation

→ Basics of Pneumatics

Recommended simulation software

– FluidSIM Pneumatics
→ Page 168

Systematic Troubleshooting
Equipment Set TP 101+



Systematic troubleshooting and competent fault rectification

Components with specific, realistic faults are included in the Systematic Troubleshooting Equipment Set TP 101+. This is how pneumatic control systems can be set up using the components of the Pneumatics Basic Level Equipment Set TP 101, and individual components can be replaced with faulty ones. This makes teaching and learning about systematic troubleshooting professional and realistic.

Each component of the equipment set has a detailed description and instructions for systematic troubleshooting, allowing the basics of systematic troubleshooting to be taught.

Without needing tools and using just one hand, the components can be flexibly arranged on a profile plate with 50 mm slot spacing to create a wide variety of pneumatic control systems. All pneumatic connections are on the top of the components so they are easily accessible. The pneumatic components are equipped with push-in fittings for plastic tubing with O.D. 4 mm.

All components are of industrial quality.

The components are supplied in practical equipment trays. The equipment trays not only fit in the drawers of the laboratory furniture but also in a Systainer.

Adhesive symbols for clearly labeling where components are stored in the equipment trays are included in the scope of delivery.

Components from the Pneumatics Basic Level Equipment Set TP 101 are required to carry out the project tasks.

Objectives
- Optimization of control systems through error analysis
- Systematic troubleshooting of pneumatic control systems
- Locating and rectifying faults

Benefits
- Components with predefined, realistic errors
- Errors are observable without special measurement technology
- Everything is supplied in an organized equipment tray for systainer and drawer

Complete Equipment Set TP 101+ in organizer	**8060284**

The most important components at a glance:

1x Double-acting cylinder, defective	5042759
1x Pressure gauge, defective	4977328
1x Filter sleeves for start-up valve with filter control valve, clogged	8064260
1x 3/2-way valve with pushbutton actuator, defective	4978036
1x 5/2-way double pilot valve, defective	4977795
1x 5/3-way valve, mid-position pressurized	576305
1x Flow control valve	193972
1x Silencer M5, clogged	4977506

Accessories, order at the same time:

Aluminum profile plate → Page 11, 17	
Compressor → Page 132	



From vocational training...



... to industrial reality

Recommended learning materials

Workbook



Campus license (→ Page 167)

de	540671
en	541088
es	542503
fr	542507

eLearning courses

→ Basic Principles of Pneumatics



→ Simple Pneumatic Circuits
→ Pneumatic Actuators
→ Pneumatic Valves
→ Pneumatic Air Treatment

eLab course

→ Basics of Pneumatics

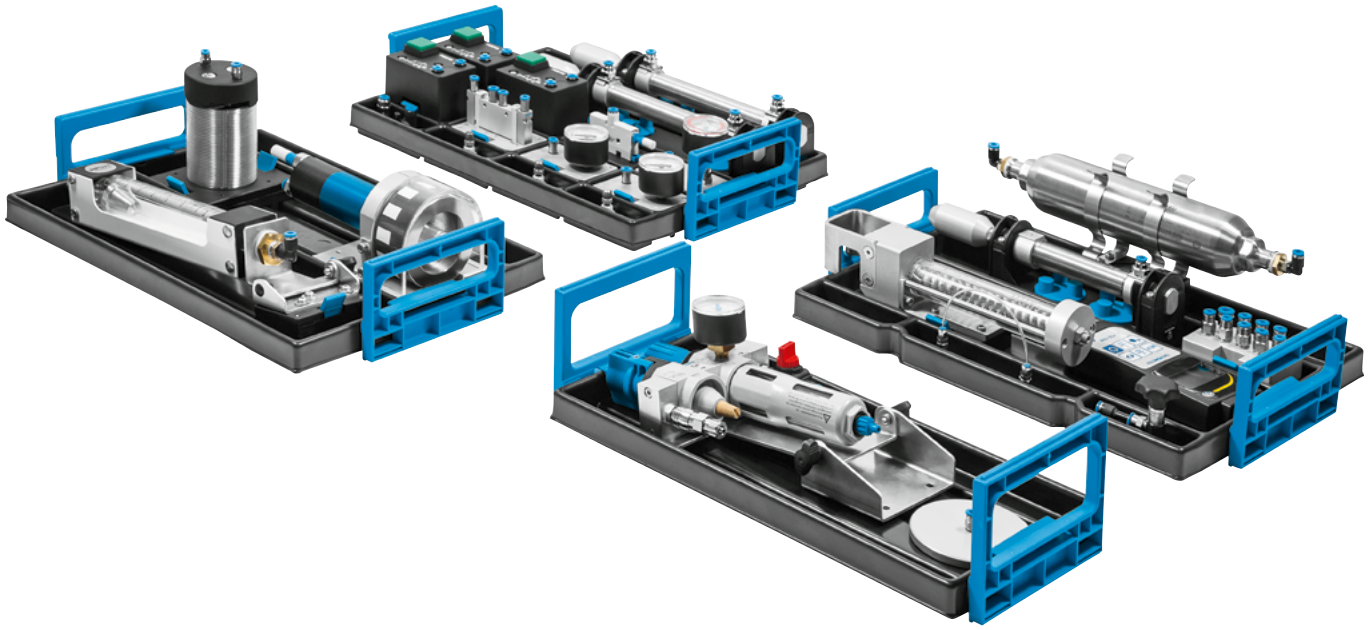


Recommended simulation software

– FluidSIM Pneumatics
→ Page 168

Pneumatics Basic Level America

Equipment Set TP 101 America



Pneumatic training with US units and according to NEMA standard.

Teach future professionals the basics of pneumatics with the new successor to the well-known Lab-Volt pneumatics equipment sets.

Objectives

- Structure and function of pneumatic components
- Control technology fundamentals and terminology
- Logical links and latch circuits
- Generation and distribution of compressed air
- Simple pneumatic control systems

Complete Equipment Set TP 101 America in organizer	**8060282**

The most important components at a glance:

1x Start-up valve with filter control valve, piloted	4795290
2x Pressure gauge	152865
3x One-way flow control valve	193967
2x 3/2-way valve with pushbutton actuator, normally closed	152860
1x 3/2-way valve with pushbutton actuator, normally open	152861
1x 5/2-way double pilot valve, pneumatically actuated at both sides	576303
1x Single-acting cylinder	152887
1x Double-acting cylinder, smooth running	4809915
1x Double-acting cylinder	152888
1x Air reservoir, 0.4 l	152912
1x Vacuum generator, type H	573258
1x Vacuum gauge	573042
1x Suction gripper 20 SN	573043
2x Plastic tubing	151496
1x Manifold	152896
1x Contact tachometer	8062148
1x Spring load for cylinders, pneumatic	4646789
1x Compressed air motor	4645172
1x Air bearing	4809899
1x Flow indicator with float, pneumatic	4741762
1x Pneumatic resistor, long	4646991
1x Pneumatic resistor, short	4809992
1x Plastic tubing, 6 x 1 silver 5 m	152963

Accessories, order at the same time:

Aluminum profile plate → Page 11, 17
Compressor → Page 132

Recommended learning materials

Workbook



Campus license (→ Page 167)

en	792258

eLearning courses

- → Basic Principles of Pneumatics
- → Pneumatic Actuators
- → Simple Pneumatic Circuits
- → Pneumatic Air Treatment
- → Pneumatic Valves

eLab course

- → Pneumatics Basic Level – TP America



Evaluation

- → Basics of Pneumatics – Pneumatics Training System

Recommended simulation software

– FluidSIM Pneumatics
→ Page 168

Basic Pneumatics America, in a Case

Portable Equipment Set TP 101 America



Straight out of the case: pneumatics training with US units and according to NEMA standard.

Teach future specialists the basics of pneumatics. This compact training package is housed in a sturdy case for easy transportation and storage. The case contains all the equipment required to carry out the practical exercises. To set up the exercises, the slotted mounting plate is removed and placed on a table.

The Pneumatics Basic Level Equipment Set, TP 101 America, is the basis for training in pneumatics and is a prerequisite for the Electropneumatics Basic Level Equipment Set, TP 201 America. The two Equipment Sets, TP 101 and TP 201, support vocational training institutions in their task of training qualified and employable skilled workers, as required by local industry.

The equipment sets come with a curriculum that is designed according to industry standards.

Meaningful objectives are clearly formulated at the beginning of each exercise. The theory for achieving these objectives is then presented in detail, with a focus on describing the components. This is followed by the practical implementation. In this section, students follow precise and safe work instructions designed to teach them the practical principles related to the stated objectives. Throughout the implementation, questions and comments ensure that students can analyze and understand the results achieved. Finally, evaluative questions are used to check the students' understanding of the topics covered in the exercise.

Safe and solid components
The design of the components guarantees a high level of inherent safety. The start-up valve with filter control valve can be padlocked to prevent unauthorized access to the compressed air supply. The spring load for the pneumatic cylinders is provided with a safety cover to avoid possible hazards posed by the occurrence of high forces.

All circuits in the course material are available in FluidSIM for reference.

Objectives
- Simple pneumatic control systems
- Control technology fundamentals and terminology
- Logical links and latch circuits
- Generation and distribution of compressed air
- Structure and function of pneumatic components

Benefits
- Flexible assembly of circuits thanks to the slotted mounting plate
- A cost-effective solution that eliminates the need for a laboratory workstation
- Easy transport allows training at different locations, even at home
- Durable and waterproof

Complete Equipment Set TP 101 America, in case	**8166271**

The most important components at a glance:

1x Slotted mounting plate	8179770
1x Start-up valve with filter control valve, piloted	4795290
2x Pressure gauge	152865
3x One-way flow control valve	193967
2x 3/2-way valve with pushbutton actuator, normally closed	152860
1x 3/2-way valve with pushbutton actuator, normally open	152861
1x 5/2-way double pilot valve, pneumatically actuated at both sides	576303
1x Single-acting cylinder	152887
1x Double-acting cylinder, smooth running	4809915
1x Double-acting cylinder	152888
1x Air reservoir, 0.4 l	152912
1x Vacuum generator, type H	573258
1x Vacuum gauge	573042
1x Suction gripper 20 SN	573043
2x Plastic tubing	151496
1x Manifold	152896
1x Contact tachometer	8062148
1x Spring load for cylinders, pneumatic	4646789
1x Compressed air motor	4645172
1x Air bearing	4809899
1x Flow indicator with float, pneumatic	4741762
1x Pneumatic resistor, long	4646991
1x Pneumatic resistor, short	4809992
1x Plastic tubing, 6 x 1 silver 5 m	152963
1x Case with foam insert	8166289

Accessories, order at the same time:

Compressor → Page 132



Recommended learning materials

Workbook



Campus license (→ Page 167)

en	792258

eLearning courses

- → Basic Principles of Pneumatics
- → Pneumatic Actuators
- → Simple Pneumatic Circuits
- → Pneumatic Air Treatment
- → Pneumatic Valves

eLab course

- → Pneumatics Basic Level – TP America



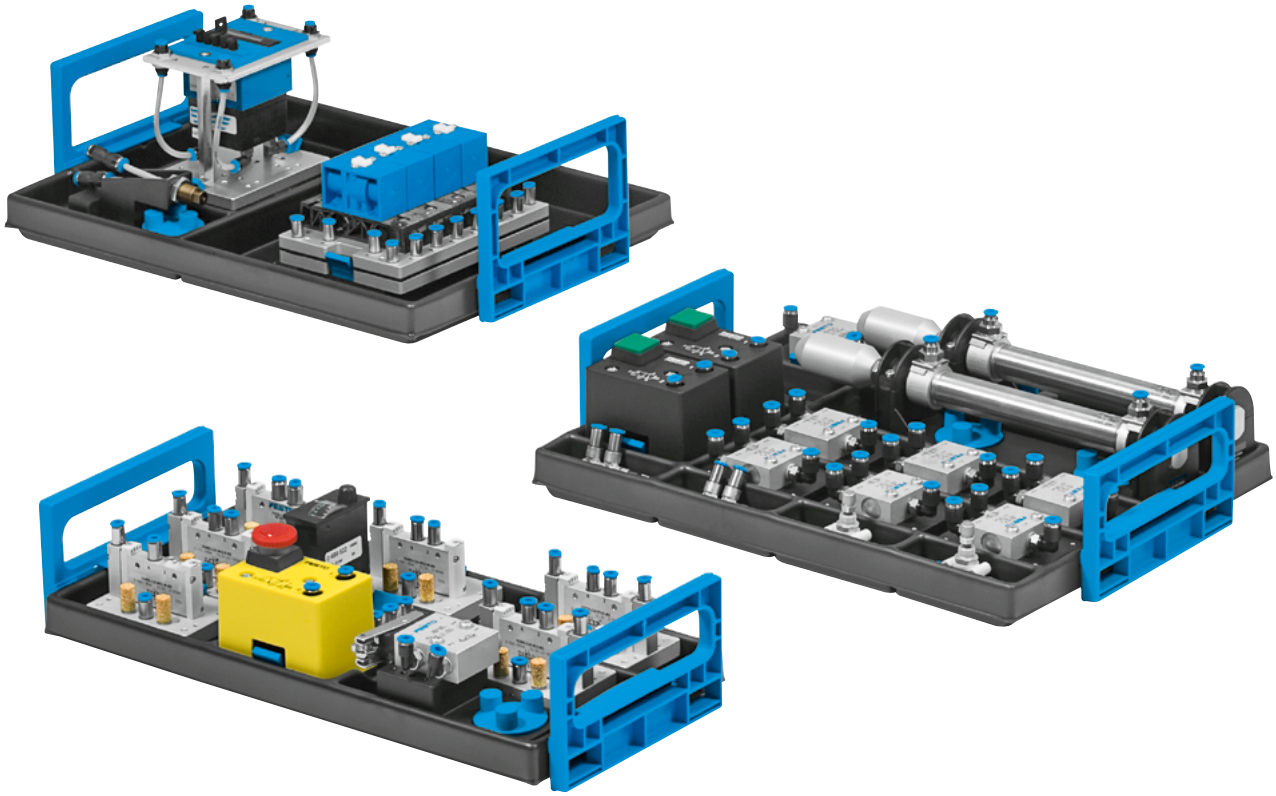
Evaluation

- → Basics of Pneumatics – Pneumatics Training System

Recommended simulation software

– FluidSIM Pneumatics
→ Page 168

Pneumatics Advanced Level
Equipment Set TP 102



Pneumatics for advanced users

The subject of the Pneumatics Advanced Level Equipment Set TP 102 is to provide further training in pneumatic control technology. The equipment set can be used to build extensive combinations of circuits with input and output signal connections, as well as controllers with sequencer modules. Building on the Pneumatics Basic Level, the training media for the advanced level contain challenging project tasks.

The number and design of the components of the equipment set and the projects of the training media are optimally coordinated. This means that the contents of the extensive control systems of the advanced level can be taught with little effort.

Without needing tools and using just one hand, the components can be flexibly arranged on a profile plate with 50 mm slot spacing to create a wide variety of pneumatic control systems. All pneumatic connections are on the top of the components so they are easily accessible. The components are equipped with push-in fittings for plastic tubing with O.D. 4 mm. All components are of industrial quality.

The components are supplied in practical equipment trays. The equipment trays not only fit in the drawers of the laboratory furniture but also in a Systainer. Adhesive symbols for clearly labeling where components are stored in the equipment trays are included in the scope of delivery.

Components from the Basic Pneumatics Equipment Set TP 101 are required to carry out the project tasks.

Objectives
- Limit switch and proximity switch for end position sensing
- Controllers with pneumatic timers and/or preset counters
- Extensive pneumatic control systems
- Memory circuits and inversion of signals
- Basic cycle step controllers and cycle step controllers with operating modes

Benefits
- Industrial quality components
- All pneumatic valves with pilot control
- The control systems can be assembled virtually without any consumables or tools
- Simple and secure placement of components with the Quick-Fix quick fastening system
- Everything is supplied in an organized equipment tray for systainer and drawer

Complete Equipment Set TP 102 in organizer	**540711**

The most important components at a glance:

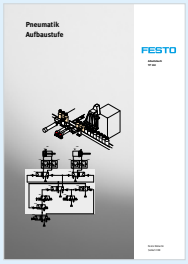
2x	3/2-way valve with pushbutton actuator, normally closed	152860
1x	3/2-way valve with mushroom-head emergency switch (red), normally open	152864
1x	3/2-way roller lever valve with idle return, normally closed	152867
1x	Back pressure valve	152868
4x	3/2-way valve, pneumatically actuated at one side	576302
2x	5/2-way double pilot valve, pneumatically actuated at both sides	576303
2x	Plastic tubing, 4 x 0.75 silver 10 m	151496
4x	Shuttle valve (OR)	539771
3x	AND valve	539770
1x	Pneumatic timer, normally open	539759
1x	Pneumatic preset counter	152877
1x	Stepper module	152886
2x	One-way flow control valve	193967
2x	Non-return valve, piloted	540715
2x	Double-acting cylinder	152888

Accessories, order at the same time:

Aluminum profile plate → Page 11, 17
Compressor → Page 132

Recommended learning materials

Workbook



Campus license (→ Page 167)

de	540672
en	541089
es	542504
fr	542508

eLearning courses

→ Basic Principles of Pneumatics



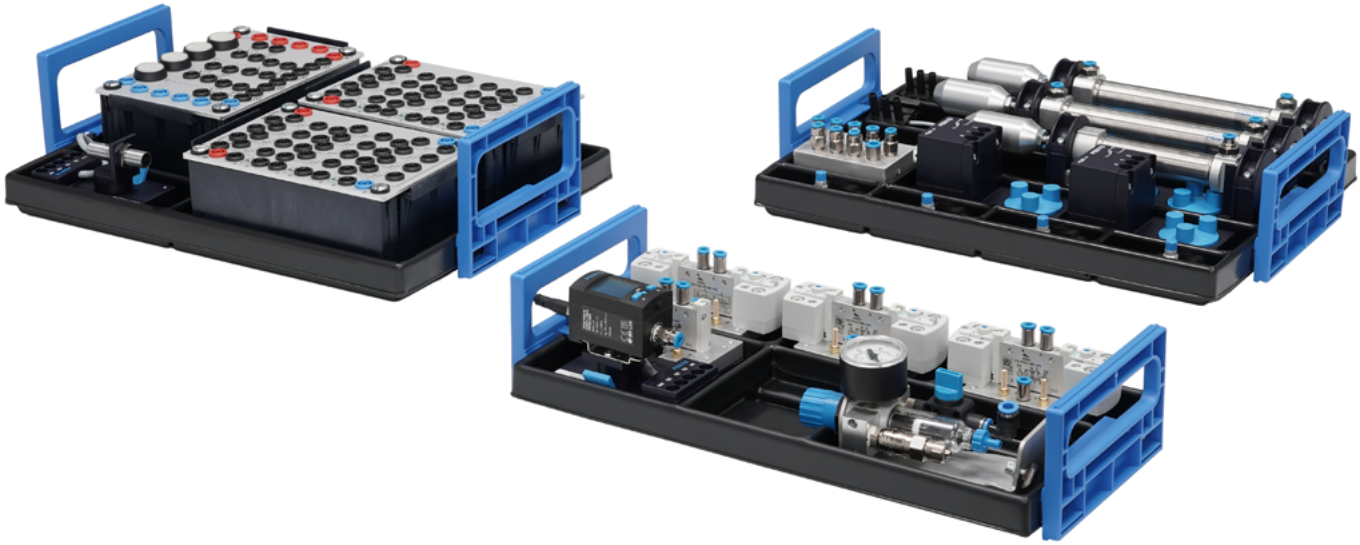
→ Simple Pneumatic Circuits
→ Pneumatic Actuators
→ Pneumatic Valves
→ Pneumatic Air Treatment



Recommended simulation software

– FluidSIM Pneumatics
→ Page 168

Basic Electropneumatics
Equipment Set TP 201



The most important basics of electropneumatic control technology in compact form

Basic training in electropneumatic control technology is the focus of the Basic Electropneumatics Equipment Set TP 201. Knowledge of the function and use of pneumatic and electrical components is imparted. The focus is on solenoid valves, electronic proximity switches and relay controls, It optimally matches the training media that communicate clear project tasks.

The number and design of the components of the equipment set and the projects of the training media are perfectly coordinated. This allows the important basic principles to be taught with little effort.

Without needing tools and using just one hand, the components can be flexibly arranged on a profile plate with 50 mm slot spacing or in an ER mounting frame to create a wide variety of pneumatic control systems. All pneumatic and electrical connections are located on the top of the components so they are easily accessible.

The pneumatic components are equipped with push-in fittings for plastic tubing with O.D. 4 mm. The electrical components have 4 mm safety sockets. All components are of industrial quality.

The components are supplied in practical equipment trays. The equipment trays not only fit in the drawers of the laboratory furniture but also in a Systainer. Adhesive symbols for clearly labeling where components are stored in the equipment trays are included in the scope of delivery.

Objectives
- Simple electropneumatic controllers
- Design and function of electrical and pneumatic components
- Calculations of basic parameters
- Logical links and latch circuits
- Troubleshooting in simple electropneumatic circuits

Benefits
- Industrial quality components
- The control systems can be assembled virtually without any consumables or tools
- Connection of the solenoid coils via 4 mm safety sockets
- Electrical control unit with relay
- Everything is supplied in an organized equipment tray for systainer and drawer

Complete Equipment Set TP 201 in organizer	**540712**

The most important components at a glance:

1x	Signal input, electrical	162242
2x	Relay 3-way	162241
1x	Limit switch, electrical, left-actuated	183322
1x	Limit switch, electrical, right actuated	183345
1x	Proximity switch, optical, M12	572744
2x	Proximity switch, electronic, with cylinder mounting	2344752
1x	2 x 3/2-way solenoid valve with LED, normally closed	567198
1x	5/2-way solenoid valve with LED	567199
2x	5/2-way double solenoid valve with LED	567200
1x	Pressure sensor with display	572745
4x	One-way flow control valve	193967
1x	Single-acting cylinder	152887
2x	Double-acting cylinder	152888
1x	Start-up valve with filter control valve	540691
1x	Manifold	152896
1x	Plastic tubing, 4 x 0.75 silver 10 m	151496

Accessories, order at the same time:

Aluminum profile plate → Page 11, 17
Compressor → Page 132
Tabletop power supply unit → www.festo.com/didactic
Power supply unit for mounting frame → Page 158
4 mm safety laboratory cables → Page 159

Basic Pneumatics to Basic Electropneumatics, Supplementary Equipment Set TP 101 – TP 201

This equipment set expands the Basic Pneumatics Equipment Set TP 101 to form a complete Basic Electropneumatics Equipment Set TP 201
Recommended learning material and accessories: see TP 201

Complete Supplementary Equipment Set TP 101 – TP 201 in organizer	**540717**

The most important components at a glance:

1x	Signal input, electrical	162242
2x	Relay 3-way	162241
1x	Limit switch, electrical, left-actuated	183322
1x	Limit switch, electrical, right actuated	183345
1x	Proximity switch, optical, M12	572744
2x	Proximity switch, electronic, with cylinder mounting	2344752
1x	2 x 3/2-way solenoid valve with LED, normally closed	567198
1x	5/2-way solenoid valve with LED	567199
2x	5/2-way double solenoid valve with LED	567200
1x	Pressure sensor with display	572745
2x	One-way flow control valve	193967
1x	Double-acting cylinder	152888

Recommended learning materials

Workbook



Campus license (→ Page 167)

de	540673
en	541090
es	542505
fr	542509

eLearning courses

→ Basic Principles of Electropneumatics



→ Basic Electropneumatic Circuits
→ Electropneumatic Components

eLab course

→ Basics of Electropneumatics



Evaluation

→ Basics of Electropneumatics

Recommended simulation software

– FluidSIM Pneumatics
→ Page 168

Basic Pneumatics to Basic Electropneumatics – America

Supplementary Equipment Set TP 101 America – TP 201 America



Electropneumatics training with US units and as per the NEMA standard

Basics of electropneumatics with the new successor of the well-known Lab-Volt electropneumatics equipment sets.

TP 201 America is an extension to TP 101 America and a comprehensive introduction to electropneumatics.

The electrical symbols in the courseware and on the components are drawn according to NEMA standards. The design and simulation software FluidSIM provides all required NEMA symbols in easy-to-access component libraries. In addition, all circuits in the courseware procedures are available in FluidSIM for reference.

The Lab-Volt Fluid Power System has been re-engineered and transferred to the training packages series from Festo Didactic.

The TP 101 America equipment set is a prerequisite for the use of TP 201 America.

Objectives
- Extensive pneumatic control systems
- Limit switch and proximity switch for end position sensing
- Latch circuits
- Process controllers
- Electropneumatic controllers with timer and/or counter

Complete Supplementary Equipment Set TP 101A — TP 201A in organizer	**8233558**

The most important components at a glance:

2x Relay 3-way	8062958
1x Signal input, electrical	8062950
1x Time relay, 2-way	8062960
1x Pressure sensor with display	8062966
1x Proximity switch, optical, M12	8062967
2x Proximity switch, electronic, with cylinder mounting	2344752
1x Limit switch, electrical, left-actuated	183322
1x Limit switch, electrical, right actuated	183345
1x 2 x 3/2-way solenoid valve with LED, normally closed	567198
1x 5/2-way solenoid valve with LED	567199
1x 5/2-way double solenoid valve with LED	567200
1x 5/3-way solenoid valve, normally closed	567201
1x Quick-exhaust valve	539772
1x Pressure regulator valve with pressure gauge	539756
1x AND valve	539770
1x Shuttle valve (OR)	539771
1x Plastic tubing, 4 x 0.75 silver 10 m	151496

Accessories, order at the same time:

Workstation systems → Page 14 – 17	
Compressors and compressor accessories → Page 132	
Tabletop power supply unit ➔ www.festo.com/didactic	
Power supply unit for mounting frame (NEMA 5-15 plug)	162411
4 mm safety laboratory cables, 106 pieces, red, blue, and black	8092668

Recommended learning materials

Workbook



Campus license (→ Page 167)

en	8233636

eLearning courses

- → Basic Principles of Electropneumatics
- → Basic Electropneumatic Circuits
- → Electropneumatic Components

eLab course

- → Electropneumatics Basic Level – TP America



Evaluation

- → Electrical Control of Pneumatic Systems - Pneumatics Training System

Recommended simulation software

– FluidSIM Pneumatics
→ Page 168

Pneumatics Basic Level to Electropneumatics Basic Level America, in a Case

Portable Supplementary Equipment Set TP 101 America – TP 201 America



Straight out of the case: electropneumatics training with US units and according to NEMA standard.

Teach future specialists the basics of electropneumatics. This compact training package is housed in a sturdy case for easy transportation and storage. The case contains all the equipment required to carry out the practical exercises. The case also contains a tabletop power supply unit and a set of safety laboratory cables.

The Basic Pneumatics Equipment Set (TP 101 A-P) equipment set is a prerequisite for using the supplementary Basic Electropneumatics Equipment Set (TP 201 A-P).

The electrical circuit symbols in the course documentation and on the components are drawn in accordance with NEMA standards. The FluidSIM® design and simulation software provides all the necessary NEMA circuit symbols in easily accessible component libraries. In addition, all circuits in the course documentation are available for reference in FluidSIM®.

Objectives
- Extensive pneumatic control systems
- Limit switch and proximity switch for end position sensing
- Latch circuits
- Process controllers
- Electropneumatic controllers with timer and/or counter

Benefits
- Flexible assembly of circuits thanks to the slotted mounting plate
- A cost-effective solution that eliminates the need for a laboratory workstation
- Easy transport allows training at different locations, even at home
- Durable and waterproof

Complete Supplementary Equipment Set TP 101A – TP 201A, in case	**8233560**

The most important components at a glance:

2x Relay 3-way	8062958
1x Signal input, electrical	8062950
1x Time relay, 2-way	8062960
1x Pressure sensor with display	8062966
1x Proximity switch, optical, M12	8062967
2x Proximity switch, electronic, with cylinder mounting	2344752
1x Limit switch, electrical, left-actuated	183322
1x Limit switch, electrical, right actuated	183345
1x 2 x 3/2-way solenoid valve with LED, normally closed	567198
1x 5/2-way solenoid valve with LED	567199
1x 5/2-way double solenoid valve with LED	567200
1x 5/3-way solenoid valve, normally closed	567201
1x Quick-exhaust valve	539772
1x Pressure regulator valve with pressure gauge	539756
1x AND valve	539770
1x Shuttle valve (OR)	539771
1x Plastic tubing, 4 x 0.75 silver 10 m	151496
1x Power supply unit for mounting frame (NEMA 5-15 plug)	162411
1x 4 mm safety laboratory cables, 106 pieces, red, blue, and black	8092668
1x Case with foam insert	8166290

Accessories, order at the same time:

Workstation systems → Page 14 – 17
Compressors and compressor accessories → Page 132
Tabletop power supply unit → www.festo.com/didactic



Recommended learning materials

Workbook



Campus license (→ Page 167)

en	8233636

eLearning courses

- → Basic Principles of Electropneumatics
- → Basic Electropneumatic Circuits
- → Electropneumatic Components

eLab course

- → Electropneumatics Basic Level – TP America



Evaluation

- → Electrical Control of Pneumatic Systems - Pneumatics Training System

Recommended simulation software

– FluidSIM Pneumatics
→ Page 168

Programmable Logic Controllers
Equipment Set TP 301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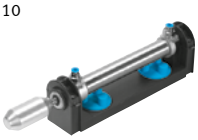

10


11


12


13

Complete Equipment Set TP 301 in organizer			**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 switch, inductive, M12	548643
4	1x	Proximity switch, capacitive, M12	548651
5	1x	Proximity switch, optical, M12	572744
6	4x	Proximity switch, 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:

Aluminum profile plate → Page 11, 17	
Universal connection unit, digital (SysLink)	162231
Tabletop power supply unit ➔ www.festo.com/didactic	
Power supply unit for mounting frame → Page 158	
4 mm safety laboratory cables → Page 159	
EduTrainer ➔ www.festo.com/didactic	

Electropneumatics Basic Level to Programmable Logic Controllers, Supplementary Equipment Set TP 201 – TP 301

You have the Equipment Set TP 201 for Electropneumatics Basic Level. This supplementary equipment set will enable you to extend the range of functions to the complete Programmable Logic Controllers Equipment Set TP 301.

Complete Supplementary Equipment Set TP 201 – TP 301 in organizer	**167102**

The most important components at a glance:

3	1x	Proximity switch, inductive, M12	548643
4	1x	Proximity switch, capacitive, M12	548651
6	2x	Proximity switch, electronic, with cylinder mounting	2344752

Objectives
- Function of the system components of a PLC
- Advantages of a PLC compared to electric, electropneumatic and electrohydraulic solutions
- Systematic programming of a PLC according to IEC 61131-3
- IEC 61131-3 programming languages
- Application criteria for mechanical, optical, capacitive, and inductive proximity switches

Benefits
- Programmable logic controllers from various manufacturers can be used
- Programming languages ladder diagram, function block diagram, statement list, structured text, and sequential function chart
- Everything is supplied in an organized equipment tray for systainer and drawer
- Industrial quality components

Also order:
Workbook, Programmable Logic Controller, Basic Level

Campus license (→ Page 167)

de	**93313**
en	**93314**
es	**94427**

Other control systems that suit your requirements
➔ www.festo.com/didactic
keyword “EduTrainer Compact”

Control Systems for Electropneumatics

Equipment Set Expansions

Equipment set expansion TP 201
Control with FluidSIM/EasyPort USB

The equipment set expansion for control systems TP 201 with FluidSIM/EasyPort USB offers the option of creating control programs as logic programs. These logic programs can be used to control simple automation processes. The EasyPort USB process interface is the interface for transmitting process signals between a real control process and FluidSIM.

Objectives
– Logic programming with FluidSIM
– Controlling electropneumatic and electrohydraulic processes
– Replace relay controllers

Benefits
– Extended application possibilities of FluidSIM
– FluidSIM controls the process via EasyPort USB
– FluidSIM P for electropneumatic control systems
– FluidSIM H for electrohydraulic control systems

1


2


3


4


5


Complete equipment set expansion for TP 201 – Control with FluidSIM/EasyPort USB	
in organizer	**556270**

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 plugs (IEEE 488), 2.5 m	34031

Requirement:

Electropneumatics Basic Level, Equipment Set TP 201 → Page 40
FluidSIM Pneumatics → Page 168

Required accessories, order at the same time:

Aluminum profile plate → Page 11, 17
Compressor → Page 132
Tabletop power supply unit ➔ www.festo.com/didactic
Power supply unit for mounting frame → Page 158
4 mm safety laboratory cables → Page 159

Equipment set expansion TP 201
Control with LOGO!

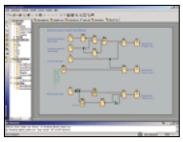
With the LOGO! 8 TP EduTrainer equipment set expansion, you get a compact mini control system with integrated connection technology for 4 mm safety plugs, allowing electrical components of the Festo Didactic equipment sets to be directly connected. LOGO! 8 TP EduTrainer equipment set expansion is used to implement simple automation projects.

Objectives
– Advantages of mini control systems
– Controlling electropneumatic and electrohydraulic processes
– Replace relay controllers
– Use programming software

Benefits
– Link between relay/contactor controllers and programmable logic controllers
– Logic programming with a mini control system
– Siemens LOGO! 8 and LOGO! Soft Comfort

6


7


8


9


Complete equipment set expansion for TP 201 - Control with LOGO!	
In organizer	**8049517**

The most important components at a glance:

6	1x Brief instructions for LOGO!, de/en/es/fr	8049519
7	1x LOGO! 8 TP EduTrainer Compact TP	8040886
8	1x LOGO! Soft Comfort, de/en/es/fr	8040050
9	1x Ethernet cable	567280

Prerequisite:

Electropneumatics Basic Level, Equipment Set TP 201 → Page 40
FluidSIM Pneumatics → Page 168

Required accessories, order at the same time:

Aluminum profile plate → Page 11, 17
Compressor → Page 132
Tabletop power supply unit ➔ www.festo.com/didactic
Power supply unit for mounting frame → Page 158
4 mm safety laboratory cables → Page 159

Electropneumatics Advanced Level
Equipment Set TP 202



Electropneumatics for advanced users

The Advanced Electropneumatics Equipment Set TP 202 is designed for further training in electropneumatic control technology. Knowledge of valve manifolds and the emergency stop function in complex electropneumatic control systems is communicated.

The number and design of the components of the equipment set and the projects of the training media are perfectly coordinated. This means that the contents of the extensive electropneumatic control systems of the advanced level can be taught with little effort.

Without needing tools and using just one hand, the components can be flexibly arranged on a profile plate with 50 mm slot spacing or in an ER mounting frame to create a wide variety of pneumatic control systems. All pneumatic and electrical connections are located on the top of the components so they are easily accessible. The pneumatic components are equipped with push-in fittings for plastic tubing with O.D. 4 mm. The electrical components have 4 mm safety sockets. All components are of industrial quality.

The components are supplied in practical equipment trays. The equipment trays not only fit in the drawers of the laboratory furniture but also in a Systainer. Adhesive symbols for clearly labeling where components are stored in the equipment trays are included in the scope of delivery.

Components from the Equipment Set TP 201 for Electropneumatics Basic Level are required to carry out the project tasks.

Objectives
- Extensive electropneumatic control systems
- Sequence controllers with signal overlap
- Electropneumatic controllers with timers
- Operating modes and emergency stop
- Troubleshooting in extensive electropneumatic control systems

Benefits
- Industrial quality components
- The control systems can be assembled virtually without any consumables or tools
- Valve terminal with 4 valve slices
- Electronic preset counter
- Everything is supplied in an organized equipment tray for systainer and drawer

Complete Equipment Set TP 202 in organizer	**8232035**

The most important components at a glance:

1x Signal input, electrical	162242
2x Relay 3-way	162241
1x Time relay, 2-way	162243
1x Emergency stop button, electrical	183347
1x Proximity switch, inductive, M12	548643
1x Proximity switch, capacitive, M12	548651
1x Valve terminal with 4 valve slices (MMJJ)	8231826
2x Non-return valve, piloted	540715

Accessories, order at the same time:

Aluminum profile plate → Page 11, 17
Compressor → Page 132
Tabletop power supply unit ➔ www.festo.com/didactic
Power supply unit for mounting frame → Page 158
4 mm safety laboratory cables → Page 159



Recommended learning materials

Workbook



Campus license (→ Page 167)

de	8235571
en	8235578
es	8235579
fr	8235580

eLearning courses

→ Electropneumatic Components



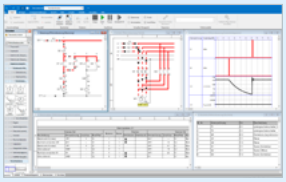
→ Basic Principles of Electropneumatics



→ Basic Electropneumatic Circuits

Recommended simulation software

– FluidSIM Pneumatics
→ Page 168



PLC Integration in Pneumatic Systems

Equipment Set TP 203



Seamless PLC Integration for Modern Training

This advanced electropneumatics training package replaces traditional relay-based control with a Siemens S7 PLC, offering learners real-world automation experience while enabling a direct comparison of relay-based and PLC-based control.

Familiar Components, New Control Logic

Using the same solenoid valves, cylinders, and sensors as traditional electropneumatic training systems which are in TP 201, this package ensures a smooth learning curve. If trainees are comfortable with relay control, they will quickly see how PLC programming replicates and enhances these functions. By working with familiar components, trainees smoothly transition from theoretical concepts to practical industrial automation. The reliable Quick-Fix mounting system ensures easy setup and adjustments.

Benefits

- Hands-on Training with Industrial components.
- Seamless Transition from Relay control of TP 201 to PLC.
- Efficient Troubleshooting and Maintenance Training: Trainees learn to diagnose and fix real-world automation issues, reducing errors and downtime in actual industrial settings.
- Cost-Effective and Future-Proof Investment:
  this system provides a long-term training solution adaptable to evolving industry needs.

Objectives

- Understanding the role of PLCs in automation
- Replacing relay logic with PLC programming
- Basic programming with Siemens TIA Portal
- Fundamentals of Function Block programming
- Simple sequencing, counting and timing operations
- Troubleshooting PLC-based electropneumatic circuits

Complete Equipment Set TP 203 in organizer	**8207873**

The most important components at a glance:

2x Proximity switch, electronic, with cylinder mounting	2344752
1x Proximity switch, capacitive, M12	548651
1x Ethernet cable	567280
1x Proximity switch, inductive, M12	548643
1x EduTrainer Compact with CPU S7-1214C	8115009
1x Weight, 2 kg, for cylinder	572778
2x Non-return valve, unlockable	540715
1x Operational mode display	567263
1x Software Simatic Step 7 Basic V19	8107521
1x Vertical cover for cylinders	8223393

Accessories, order at the same time:

Aluminum profile plate → Page 11, 17
Compressor → Page 132
Tabletop power supply unit ➔ www.festo.com/didactic
Power supply unit for mounting frame → Page 158
4 mm safety laboratory cables → Page 159

Prerequisite:

Electropneumatics Basic Level, Equipment Set TP 201 → Page 40

Equipment Set TP 203 in organizer excluding PLC and software	**8208294**

Recommended learning materials

Workbook

Campus license (→ Page 167)

de	8216250
en	8216251
es	8216253
fr	8216252

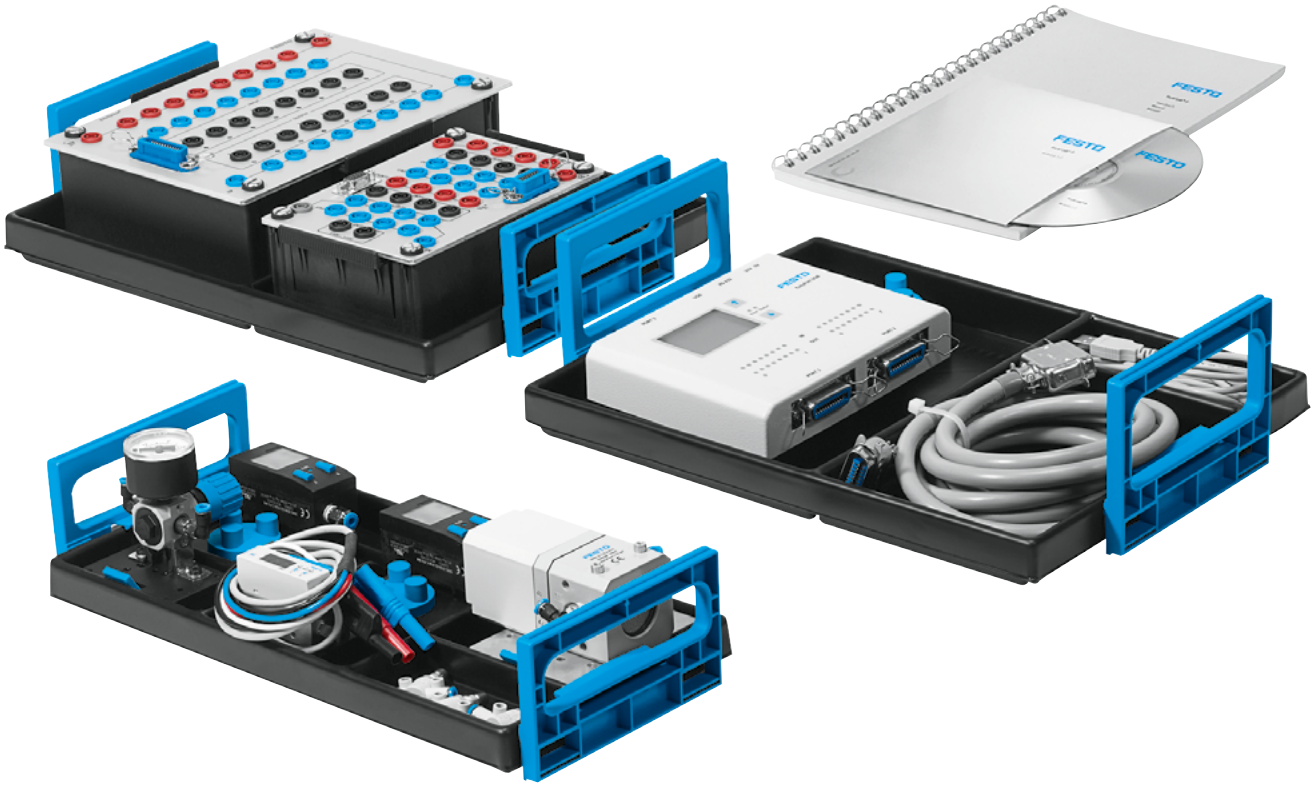
eLab course

→ Basic of PLC Programming (S7) with TP 203



Measurement and Control in Pneumatics with FluidLab-P

Equipment Set TP 210



Diagnostics, maintenance, and energy efficiency

The Measurement and Control in Pneumatics with FluidLab-P Equipment Set TP 210 covers the topics of measurement and control in pneumatics. The content ranges from measuring individual pneumatic components to the basics of condition monitoring and control technology. The importance of dealing responsibly with compressed air as a form of energy is also clearly highlighted in order to raise awareness.

The number and design of the components in the equipment set and the project tasks stored in the FluidLab-P software are optimally coordinated. This enables the basics of measuring and analyzing the system and control behavior of pneumatic/electropneumatic control systems to be taught.

Without needing tools and using just one hand, the components can be flexibly arranged on a profile plate with 50 mm slot spacing or in an ER mounting frame to create a wide variety of pneumatic control systems. All pneumatic and electrical connections are located on the top of the components so they are easily accessible. The pneumatic components are equipped with push-in fittings for plastic tubing with O.D. 4 mm. The electrical components have 4 mm safety sockets or M8/M12 industrial connectors. All components are of industrial quality.

The components are supplied in practical equipment trays. The equipment trays not only fit in the drawers of the laboratory furniture but also in a Systainer. Adhesive symbols for clearly labeling where components are stored in the equipment trays are included in the scope of delivery.

Components from the Basic Electropneumatics (TP 201) and Basic Pneumatics (TP 101) equipment sets are required to complete the project exercises.

Objectives
- Basics of gathering and processing measurement
- Selection and adaptation of sensors
- Characteristic curves and characteristic values of electropneumatic components
- Characteristics and applications of proportional-pressure regulators
- Control technology with continuous and discontinuous regulators

Benefits
- Fast PC-supported measured value recording
- Functional test and optimization of pneumatic and hydraulic controllers
- FluidLab-P license included
- Everything is supplied in an organized equipment tray for systainer and drawer

Complete Equipment Set TP 210 in organizer	**556228**

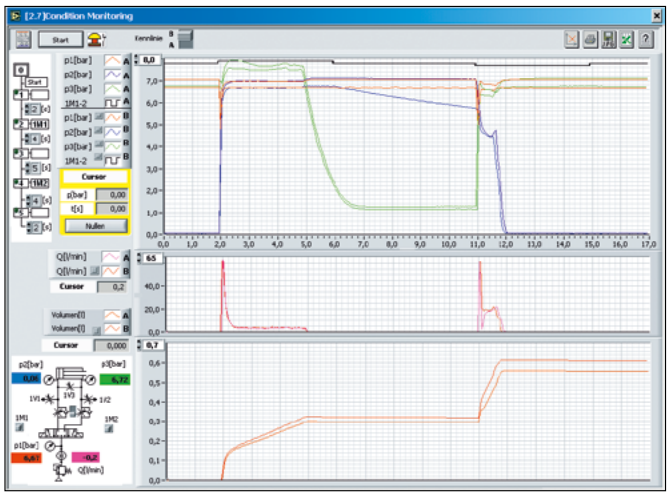
The most important components at a glance:

1x I/O data cable with SysLink plugs (IEEE 488), 2.5 m	34031
1x Universal connection unit, digital (SysLink)	162231
1x Terminal unit, analog	567232
1x Analog cable, parallel, 2 m	529141
1x EasyPort USB	548687
1x Quick-Fix screw adapter	549806
2x Pressure sensor with display	572745
1x Flow sensor, 0.5 – 50 l/min, analog	8036235
1x Proportional-pressure regulator	539779
1x Pressure regulator valve with pressure gauge	539756
3x Flow control valve	193972
1x Plastic tubing, 4 x 0.75 silver 10 m	151496
1x FluidLab-P single license, de/en	556241
2x Non-return valve, piloted	540715

Force measurement option:
The force sensor (order no. 539780), which is not included in the scope of delivery, is required for the exercises on piston force measurement.

Accessories, order at the same time:

Aluminum profile plate → Page 11, 17	
Compressor → Page 132	
Tabletop power supply unit → www.festo.com/didactic	
Power supply unit for mounting frame → Page 158	
4 mm safety laboratory cables → Page 159	
Force sensor	539780



Including FluidLab-P
A key component of the training package TP 210 is the FluidLab-P software. The interface is set up, the sensors adapted and the language selected in just a few simple steps. The exercises can then be started immediately. They are divided into basic tests, cylinder controls, proportional technology, and closed-loop control technology. Implementation is supported by connection diagrams, descriptions, and sample solutions. The software also takes over the control of the measurement process. Results can be measured using measuring points, and then printed or exported to a spreadsheet program. In addition, the software includes the entire set of exercises as a PDF file.

Recommended learning materials

eLearning courses
→ Basic Principles of Pneumatics

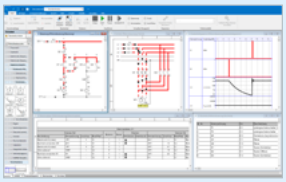


→ Basic Principles of Electropneumatics



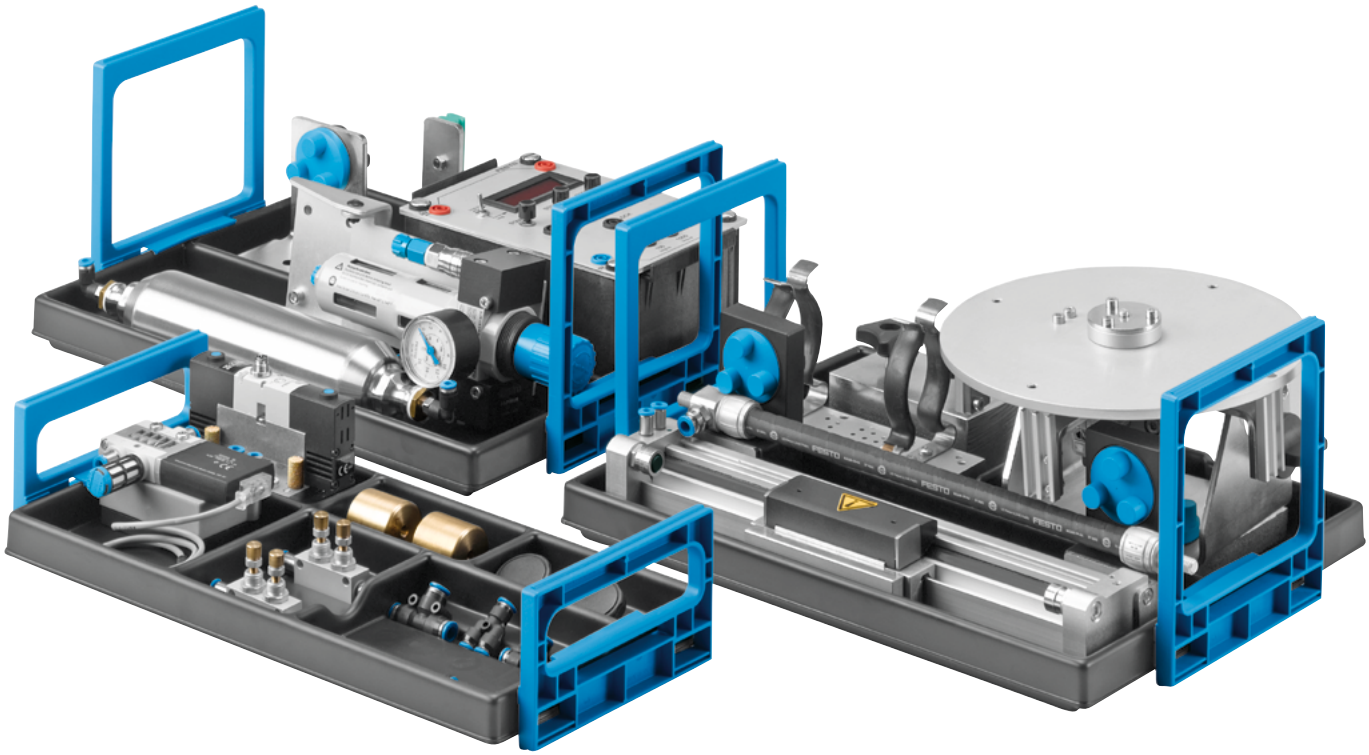
Evaluations
→ Basics of Pneumatics
→ Basics of Electropneumatics

Recommended simulation software
– FluidSIM Pneumatics
→ Page 168



Drives in Pneumatics

Equipment Set TP 220



Optimum drives for applications

How to select and size different modern drive types, taking into account their special properties, is taught in the Drives in Pneumatics Equipment Set TP 220. Economic and safety considerations are also addressed.

The number and design of the components of the equipment set and the projects of the training media are optimally coordinated. They can be used to teach the basics of pneumatic drives.

Without needing tools and using just one hand, the components can be flexibly arranged on a profile plate with 50 mm slot spacing or in an ER mounting frame to create a wide variety of pneumatic control systems. All pneumatic and electrical connections are located on the top of the components so they are easily accessible.

The pneumatic components are equipped with push-in fittings for plastic tubing with O.D. 4 mm. The electrical components have 4 mm safety sockets or M8 industrial connectors. All components are of industrial quality.

The components are supplied in practical equipment trays. The equipment trays not only fit in the drawers of the laboratory furniture but also in a Systainer. Adhesive symbols for clearly labeling where components are stored in the equipment trays are included in the scope of delivery.

Components from the equipment sets for Electropneumatics Basic Level (TP 201), Electropneumatics Advanced Level(TP 202) and Pneumatics Basic Level (TP 101) are required to complete the project exercises.

Objectives

- Designing a compressed air network
- Sizing the pneumatic power unit
- Selecting the drive
- Energy efficiency in pneumatic control systems
- Response of pneumatic control systems to a power failure

Benefits

- Industrial quality components
- 3/2-way fast-switching valve and 5/3-way solenoid valve, mid-position closed
- Rodless cylinder, semi-rotary drive, pneumatic muscle
- Operating behavior of pneumatic drives under load
- Everything is supplied in an organized equipment tray for systainer and drawer

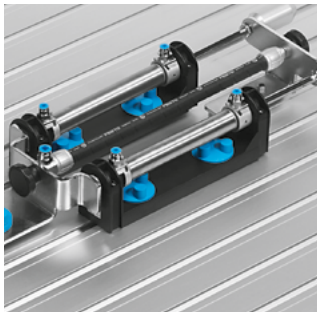
Complete Equipment Set TP 220 in organizer	**541184**

The most important components at a glance:

1x Pneumatic muscle with protective hood, size 10	544311
1x Semi-rotary actuator, size 16, 180°	544313
1x Linear drive with protective hood, size 18, 170 mm stroke	8182981
1x Function generator/counter/stopwatch	544315
1x 3/2-way fast-switching solenoid valve, normally closed	544312
1x 5/3-way solenoid valve, normally closed	567201
2x Double one-way flow control valve	548634
1x Proximity switch, electronic	2342009
1x Start-up valve with filter control valve	540691
2x Weight, 175 g	548581
1x Weight, 2 kg	548582
1x Air reservoir, 0.4 l	152912

Accessories, order at the same time:

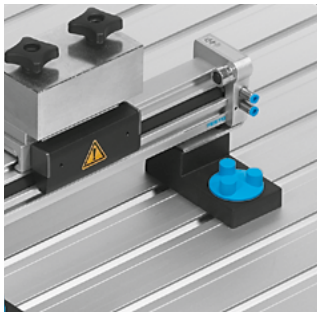
Aluminum profile plate → Page 11, 17
Tabletop power supply unit ➔ www.festo.com/didactic
Power supply unit for mounting frame → Page 158
4 mm safety laboratory cables → Page 159



Pneumatic muscles
The pneumatic muscle is a traction actuator modeled on the biological muscle. Stick-slip free, it offers up to 10 times the initial force of normal cylinders with the same diameter. You will learn how the muscle can be used as a single-acting actuator



Semi-rotary drive
The semi-rotary drive transmits the force directly to the drive shaft via the vane. The swivel angle is freely adjustable from 0 – 180°. You will learn about the importance of the mass moment of inertia in semi-rotary drives and how the operating behavior under load can be influenced in different installation positions.



Linear drive
The rodless cylinder is mechanically coupled to the slide, which is used directly to pick up loads. You will learn which steps need to be taken to achieve the optimum operating behavior and which of these options are suitable for which application

Recommended learning materials

Workbook



Campus license (→ Page 167)

de	549982
en	559880
es	559881
fr	559882

eLearning courses

→ Pneumatic Actuators



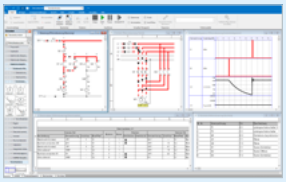
→ Basic Principles of Electropneumatics

eLab course

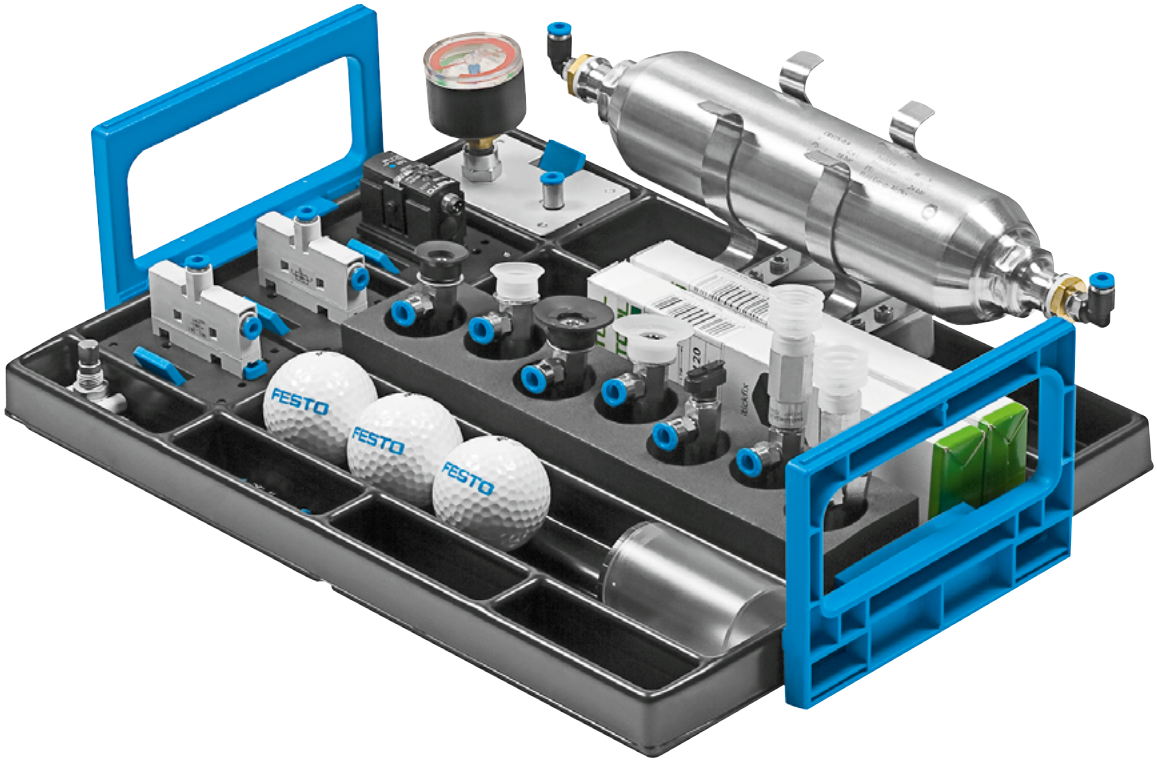
→ Basics of Electropneumatics

Recommended simulation software

– FluidSIM Pneumatics
→ Page 168



Vacuum Technology
Equipment Set TP 230



Handling with vacuum

Handling workpieces with suction pads has become an integral part of handling technology, as it offers advantages such as the simple design of suction grippers and gentle workpiece handling. In addition, fast cycle times are possible and the investment costs are comparatively low. This content is dealt with comprehensively using the Vacuum Technology Equipment Set TP 230.

The number and design of the components of the equipment set and the projects of the training media are optimally coordinated. This allows the basics of vacuum technology to be taught.

Without needing tools and using just one hand, the components can be flexibly arranged on a profile plate with 50 mm slot spacing to create a wide variety of pneumatic control systems. All pneumatic and electrical connections are located on the top of the components so they are easily accessible. The pneumatic components are equipped with push-in fittings for plastic tubing with O.D. 4 mm. The electrical components have 4 mm safety sockets or M8 industrial connectors. All components are of industrial quality.

The components are supplied in practical equipment trays. The equipment trays not only fit in the drawers of the laboratory furniture but also in a Systainer. Adhesive symbols for clearly labeling where components are stored in the equipment trays are included in the scope of delivery.

The components from the Equipment Set TP 201 for Electropneumatics Basic Level are required to carry out the project tasks.

Objectives
- Generation of negative pressure/ vacuum
- Design of vacuum applications
- Selecting suction grippers
- Function and use of ejectors according to the Venturi principle
- Compressed air consumption in a vacuum system

Benefits
- Introduction to vacuum technology
- Vacuum components in handling technology
- Vacuum security valves when using several suction grippers
- Industrial quality components
- Everything is supplied in an organized equipment tray for systainer and drawer

Complete Equipment Set TP 230 in organizer	**573041**

The most important components at a glance:

1x Air reservoir, 0.4 l	152912
1x Pressure switch, 0 – -1 bar	548624
1x Vacuum gauge	573042
1x Flow control valve	193972
1x Vacuum generator, type H	573258
1x Vacuum generator, type L	573259
1x Non-return valve	153462
1x Non-return valve, piloted	540715
1x Suction gripper 20 SN	573043
1x Suction gripper 30 SN	573044
1x Suction gripper 20 SS	573045
1x Suction gripper 30 SS	573046
2x Suction gripper 20 CS with vacuum security valve	573047
1x Suction gripper 4x20 ON	573257
Different materials and workpieces	

Required accessories, order at the same time:

Aluminum profile plate → Page 11, 17
Compressor → Page 132
Tabletop power supply unit ➔ www.festo.com/didactic
Power supply unit for mounting frame → Page 158
4 mm safety laboratory cables → Page 159

Recommended learning materials

Workbook



Campus license (→ Page 167)

de	567257
en	567258
es	567260
fr	567259

eLearning courses

→ Basic Principles of Pneumatics



→ Basic Principles of Electropneumatics



eLab course

→ Basics of Electropneumatics

Recommended simulation software

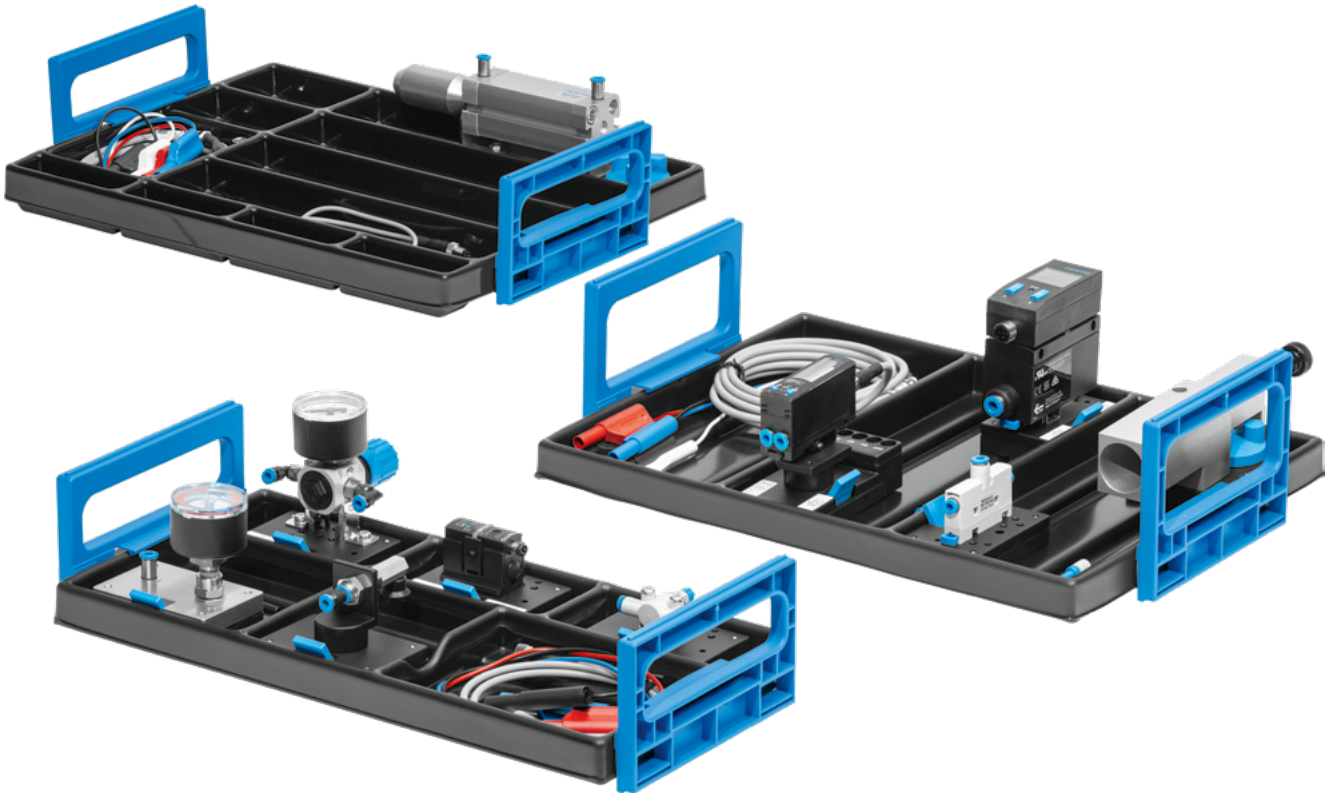
– FluidSIM Pneumatics
→ Page 168

Other learning materials

– Set of Posters on Pneumatics
→ Page 170

Sensors in Pneumatics

Equipment Set TP 240



The sensory ability of a pneumatic control system

The equipment set TP 240 allows you to expand the learning content of the training package TP 201 to include the topic of sensors in pneumatics. It deals comprehensively with topics specifically related to sensors in pneumatic control environments, including the use of pressure and flow sensors to the application of analog position transmitters and sensors for vacuum technology.

Practical relevance plays a decisive role in conveying the contents. Examples are used to demonstrate the general operating principles of the different sensors. Special attention is paid to the selection of the correct sensor, its connection, correct adjustment, and verifying its functionality.

With the TP 240, the basic knowledge of sensors in pneumatics can be widely taught.

The components from the Equipment Set TP 201 for Electropneumatics Basic Level are required to carry out the project tasks.

Objectives

- Basics of connection and circuit technology
- The basics of gathering and processing measurement data
- Various methods for pressure and flow measurement
- Design, function, and possible applications of the sensors used
- Select suitable sensors taking the requirements into account
- Differences between absolute, relative, and differential pressure measurement

Complete Equipment Set TP 240 in organizer	**8173836**

The most important components at a glance:

1x Position transmitter, 0 – 50 mm, analog	8173835
1x Electronic pressure sensor, 0 – 10 bar	548622
1x Flow sensor, 0.5 – 50 l/min, analog	8036235
1x Pressure switch, 0 – -1 bar	548624
1x Vacuum generator	548628
1x Suction gripper, 10 mm diameter	560158
1x One-way flow control valve	560159
1x Pressure regulator valve with pressure gauge	539756
1x Stop, 35 mm adjustment path	548630
1x Double-acting profile cylinder	549832

Accessories, order at the same time:

Aluminum profile plate → Page 11, 17
Tabletop power supply unit → www.festo.com/didactic
Power supply unit for mounting frame → Page 158
4 mm safety laboratory cables → Page 159

Recommended learning materials

Workbook



Campus license (→ Page 167)

de	8176985
en	8176986
es	8176987
fr	8176988

eLearning courses

→ Sensors in Pneumatics



→ Basic Principles of Electropneumatics

→ Electropneumatic Components



eLab course

→ Basics of Electropneumatics

Recommended simulation software

– FluidSIM Pneumatics → Page 168

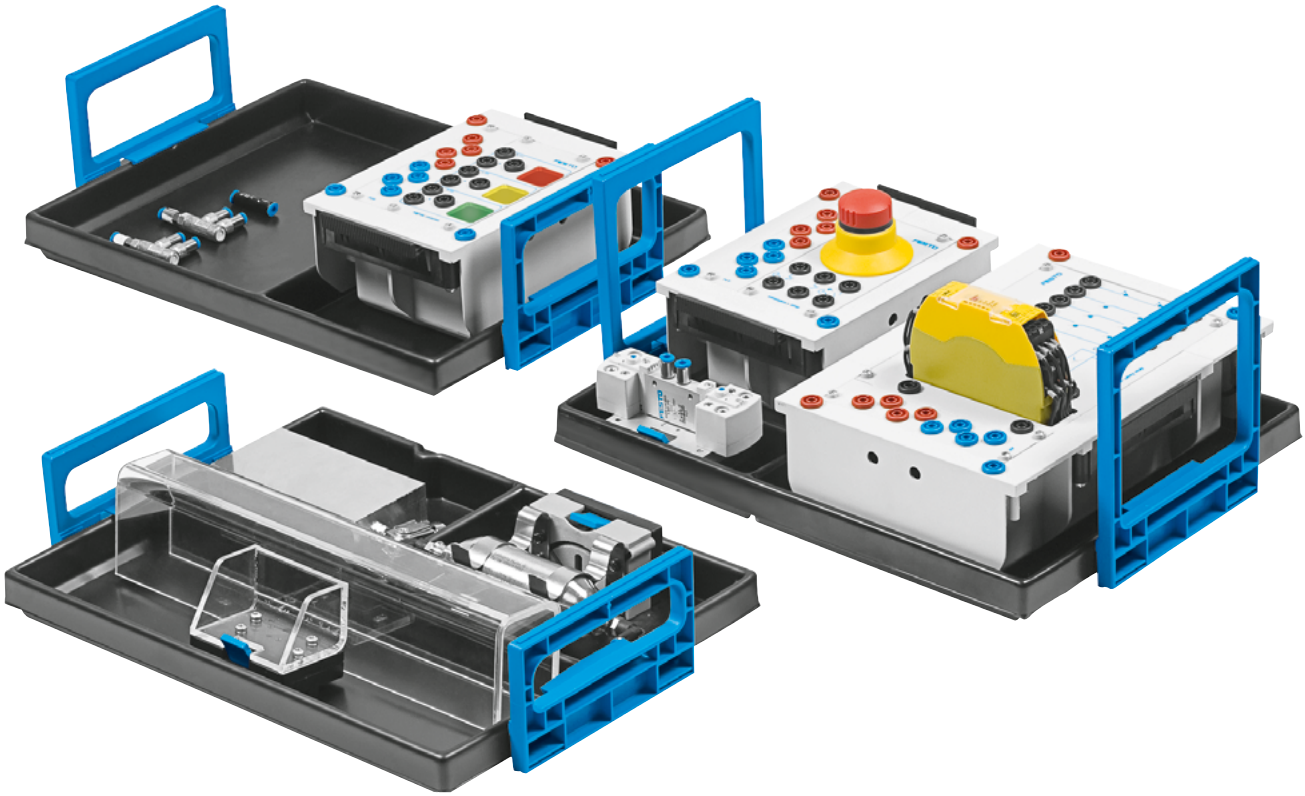
– FluidLab-P → Page 53

Other learning materials

– Set of Posters on Pneumatics → Page 170

Safety in Pneumatic Systems

Equipment Set TP 250



Reducing risks!

The contents of Pneumatics Basic Level TP 101 and Electropneumatics Basic Level TP 201 are extended by the Equipment Set TP 250 for Safety in Pneumatic Systems to include the systematic optimization of safety in systems with pneumatic drives. The aim of this training package is to detect risks in pneumatic processes, to assess the risks for a simple "machine", to learn what measures can be used to reduce risks and how to implement them properly.

Alongside function and economic efficiency, safety is one of the key success factors of any machine. Furthermore, new directives and laws require intelligent solutions and increase the level of training requirements. As a result, there is a wide range of different products, information, and training for safety engineering. However, most of these focus on the control level.

This means that safety usually ends at the output of a fail-safe PLC, for example. But as risks frequently arise in the power section, it is important to develop the ability to reduce risk in that area too.

The number and design of the components of the equipment set and the projects of the training media are optimally coordinated. This allows the basics of pneumatic system safety to be taught.

Without needing tools and using just one hand, the components can be flexibly arranged on a profile plate with 50 mm slot spacing or in an ER mounting frame to create a wide variety of pneumatic control systems.

All pneumatic and electrical connections are located on the top of the components so they are easily accessible. The pneumatic components are equipped with push-in fittings for plastic tubing with O.D. 4 mm. The electrical components have 4 mm safety sockets or M8 industrial connectors. All components are of industrial quality.

The components are supplied in practical equipment trays. The equipment trays not only fit in the drawers of the laboratory furniture but also in a Systainer. Adhesive symbols for clearly labeling where components are stored in the equipment trays are included in the scope of delivery.

Components from the Basic Electropneumatics (TP 201) and Basic Pneumatics (TP 101) equipment sets are required to complete the project exercises.

Objectives
- Hazards in pneumatic processes
- Measures to mitigate risks
- Safety measures and safety circuits of the EC Machinery Directive
- Reliability of safety functions

Benefits
- Industrial quality components
- Technical safety functions
- Safety relays and guards
- Electrical connections via 4 mm safety sockets
- Everything is supplied in an organized equipment tray for systainer and drawer

Complete Equipment Set TP 250 in organizer	**567264**

The most important components at a glance:

1x Air reservoir, 0.1 l	573281
2x Non-return valve, piloted	540715
1x 5/3-way solenoid valve, normally closed	567201
1x Non-return valve	153462
1x Weight, 2 kg, for cylinder	572778
1x Cover for cylinder	572777
1x Operational status display	567263
1x Mushroom-head safety switch	567261
1x Safety relay for emergency stop and safety door	567262

Required accessories, order at the same time:

Aluminum profile plate → Page 11, 17
Compressor → Page 132
Tabletop power supply unit ➔ www.festo.com/didactic
Power supply unit for mounting frame → Page 158
4 mm safety laboratory cables → Page 159

Recommended learning materials

Workbook



Campus license (→ Page 167)

de	567265
en	567266
es	567267
fr	567268

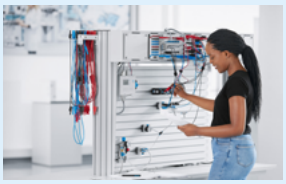
eLearning courses

→ Safety engineering



eLab course

→ Basics of Electropneumatics



Recommended simulation software

– FluidSIM Pneumatics
→ Page 168
– FluidLab-P → Page 53

Other learning materials

– Set of Posters on Pneumatics
→ Page 170

Digitalization in Pneumatics with SIMATIC S7

Equipment Set TP 260.v2



Ready for digitalization and Industry 4.0!

The Equipment Set TP 260.v2 for Digitalization in Pneumatics with SIMATIC S7 provides an introduction to intelligent maintenance and gathering operating data. This is about collecting and evaluating data that is continuously gathered from electropneumatic control systems. A programmable logic controller (PLC) controls the actuators, processes the sensor signals, and transfers the recorded data to a web server. The causes of faults as defined by the students and measures to rectify them are transmitted to mobile terminals to help with the systematic troubleshooting process.

The number and design of the components of the equipment set and the projects of the training media are optimally coordinated. This enables the basics of digitalizing electropneumatic controllers to be taught.

Without needing tools and using just one hand, the components can be flexibly arranged on a profile plate with 50 mm slot spacing or in an ER mounting frame to create a wide variety of pneumatic control systems. All pneumatic and electrical connections are located on the top of the components so they are easily accessible. The pneumatic components are equipped with push-in fittings for plastic tubing with O.D. 4 mm.

The electrical components have 4 mm safety sockets or M8 industrial connectors. All components are of industrial quality.

The components are supplied in practical equipment trays. The equipment trays not only fit in the drawers of the laboratory furniture but also in a Systainer. Adhesive symbols for clearly labeling where components are stored in the equipment trays are included in the scope of delivery.

Components from the Equipment Set TP 201 for Electropneumatics Basic Level are required to carry out the project tasks.

Objectives
- Tasks of the industrial mechanic as well as the support of digitalization for maintenance
- Analyzing a simple control system with regard to digitalization options
- Selecting the appropriate sensors for the acquisition of digital data
- Analyzing digital data for condition monitoring
- Implementation of a network system for receiving digital data

Benefits
- Industrial quality components
- Siemens S7-1200 with analog inputs and outputs
- Entry into digitalization, smart maintenance, and Industry 4.0
- Setting up a communication network
- Automatic email dispatch of the system in the event of an error

Complete Equipment Set TP 260.v2 in organizer	**8107242**

The most important components for both equipment sets at a glance:

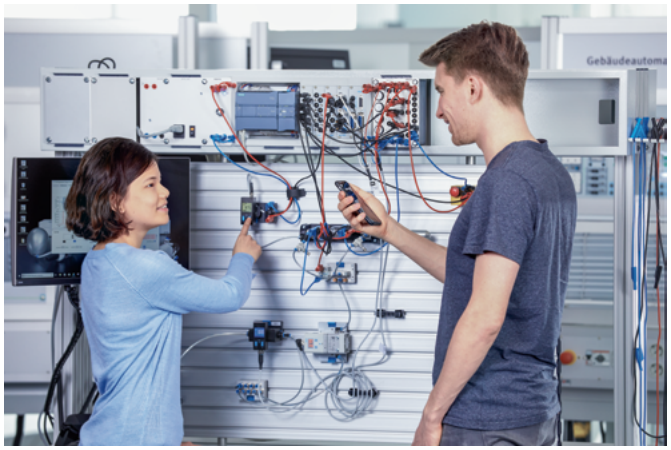
1x Proportional pressure regulator with display	8108025
1x Flow sensor, 0.5 – 50 l/min, analog	8036235
1x Emergency stop button, electrical	183347
1x EduTrainer Compact preferred variants with SIMATIC S7-1200	8115009
1x Software Simatic Step 7 (TIA Portal) V15, de/en/es/fr	8107521
3x Ethernet cable, RJ45, CAT5	567280
1x Access point, WLAN router	8086515
1x Mini desktop PC	8201552
1x Double-acting cylinder, defective	5042759
2x Proximity switch, electronic, with cylinder mounting	2344752
1x Filter sleeves for start-up valve with filter control valve, clogged	8064260
1x Multi-socket strip for IEC power cable	8201549

Accessories, order at the same time:

2x IEC power cable → www.festo.com/didactic	
Aluminum profile plate → Page 11, 17	
Compressors and compressor accessories → Page 132	
Power supply unit for mounting frame → Page 158	
4 mm safety laboratory cables, 106 pieces, red, blue, and black	8092668

Prerequisite:

Electropneumatics Basic Level, Equipment Set TP 201 → Page 40



Recommended learning materials

Workbook TP 260.v.2



Campus license (→ Page 167)

de	8111486
en	8111487
es	8111488
fr	8111489

eLearning courses

→ Basic Principles of Electropneumatics



→ Electropneumatic Components

eLab course

→ Digitalization in Pneumatics



Recommended simulation software

– FluidSIM Pneumatics
→ Page 168
– FluidLab

Other learning materials

– Set of Posters on Pneumatics
→ Page 170

Digitalization in Pneumatics with LOGO!

Equipment Set TP 260.v1



Digitalization and Industry 4.0 with LOGO!

Digitalization in Pneumatics with LOGO, Equipment Set TP 260.v1, provides an introduction to intelligent maintenance and the recording of operating data.

Through 15 exercises in the workbook, students acquire the following skills:
- Understanding the role of the maintenance technician in I4.0
- Analyzing a simple machine with regard to digitalization options
- Selecting the appropriate sensors for the acquisition of digital data for condition monitoring
- Analyzing digital data for predictive maintenance measures
- Implementation of a network system for receiving digital data
- Implementation of an intelligent troubleshooting system
- Improving machine speed, machine availability, process reliability, and production efficiency

You can use these practical examples from the field of maintenance to prepare your students for digitalization and smart maintenance, and make them fit for the future.

The learning path at a glance
- Designing a machine and using it to realize production
- Brainstorming to improve machine efficiency and thus customer satisfaction
- Selecting sensors and software for digital evaluations
- Defining limit values and providing suitable information in the event of overruns/underruns

Complete Equipment Set TP 260.v1 in organizer	**8083380**

The most important components at a glance:

1x Proportional pressure control valve	539779
1x Flow sensor, 0.5 – 50 l/min, analog	8036235
1x Emergency stop button, electrical	183347
1x LOGO!	8084384
1x LOGO! Soft Comfort V8.1	8040050
3x Ethernet cable, RJ45, CAT5	567280
1x Multi-socket strip for IEC power cable	8201549

Accessories, order at the same time:

2x IEC power cable → www.festo.com/didactic	
Aluminum profile plate → Page 11, 17	
Compressors and compressor accessories → Page 132	
Power supply unit for mounting frame → Page 158	
4 mm safety laboratory cables, 106 pieces, red, blue, and black	8092668
1x Mini desktop PC	8201552

Prerequisite:

Electropneumatics Basic Level, Equipment Set TP 201 → Page 40



Recommended learning materials

Workbook TP 260.v.1



Campus license (→ Page 167)

de	8083281
en	8083285
es	8093273
fr	8093274

eLearning courses

→ Basic Principles of Electropneumatics



→ Electropneumatic Components

eLab course

→ Digitalization in Pneumatics



Recommended simulation software

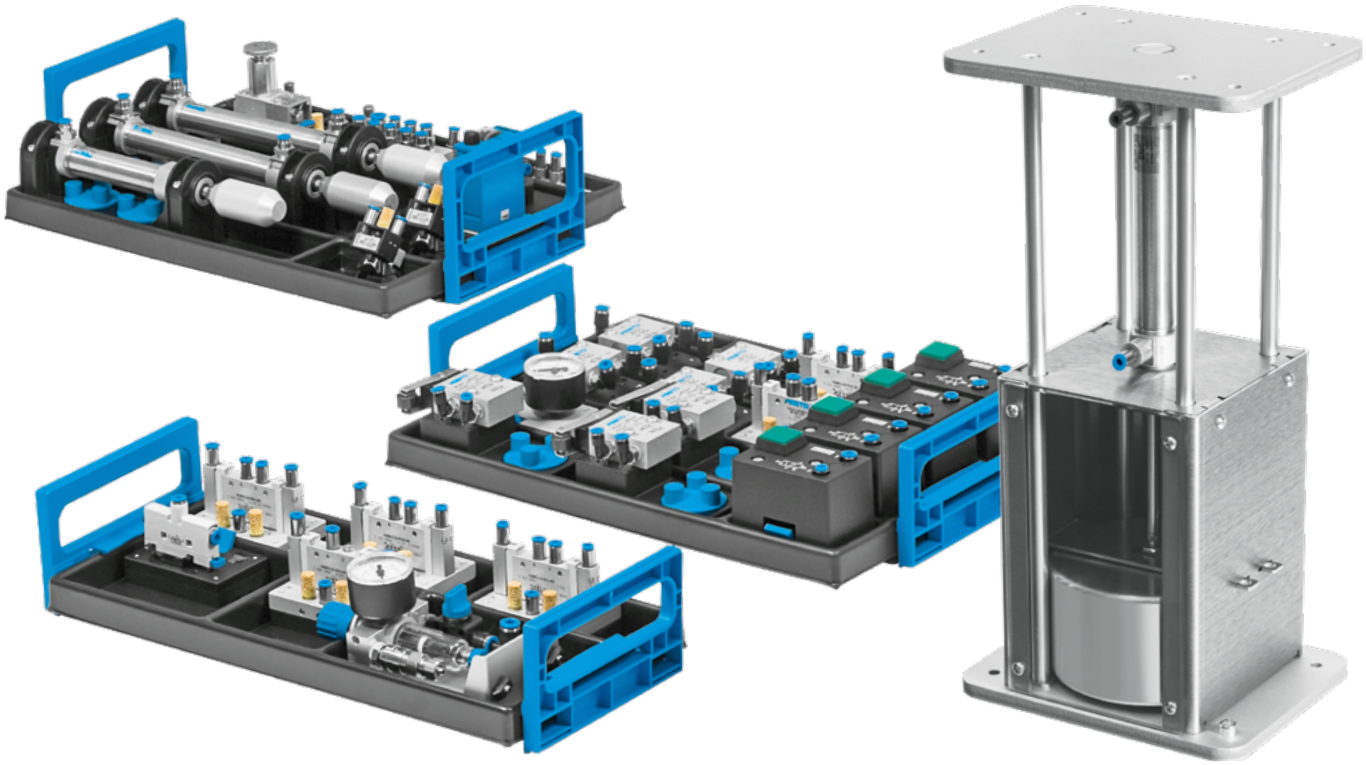
– FluidSIM Pneumatics
→ Page 168
– FluidLab

Other learning materials

– Set of Posters on Pneumatics
→ Page 170

Suitable for the Pneumatics course from the Federal Institute for Vocational Education and Training

Pneumatics, Equipment Set from the BIBB



Jam-packed with the basics of pneumatics!

The composition of the components of this equipment set is tailored to the training course of the Federal Institute for Vocational Education and Training (BIBB). The training documents and the equipment set enable basic training in pneumatic control technology.

Without needing tools and using just one hand, the components can be flexibly arranged on a profile plate with 50 mm slot spacing to create a wide variety of pneumatic control systems. All pneumatic connections are on the top of the components so they are easily accessible. The components are equipped with push-in fittings for plastic tubing with O.D. 4 mm. All components are of industrial quality.

The components are supplied in practical equipment trays. The equipment trays not only fit in the drawers of the laboratory furniture but also in a Systainer. Adhesive symbols for clearly labeling where components are stored in the organizer

Objectives
- Physical basics of pneumatics
- Control technology fundamentals and terminology
- Function and structure of pneumatic components
- Simple controllers, controllers with boundary conditions and program controllers
- Troubleshooting for extensive pneumatic control systems

Benefits
- Industrial quality components
- The control systems can be assembled virtually without any consumables or tools
- The components are placed simply and securely with the Quick-Fix quick fastening system
- Pneumatic connections are on top of the components and easily accessible
- Everything is supplied in an organized equipment tray for systainer and drawer

Complete BIBB Pneumatics Equipment Set in organizer	**549840**

The most important components at a glance:

3x 3/2-way valve with pushbutton actuator, normally closed	152860
1x 3/2-way valve with pushbutton actuator, normally open	152861
3x 3/2-way roller lever valve, normally closed	152866
1x 3/2-way valve, pneumatically actuated at one side	576302
1x 5/2-way valve, pneumatically actuated at one side	576307
3x 5/2-way double pilot valve, pneumatically actuated at both sides	576303
1x 5/3-way valve, mid-position closed	576304
1x Pneumatic timer, normally closed	540694
1x Pressure sequence valve	152884
1x Shuttle valve (OR)	539771
3x AND valve	539770
1x Quick-exhaust valve	539772
2x One-way flow control valve	193967
2x Non-return valve, piloted	540715
2x Proximity switch, pneumatic, with cylinder mounting	2764815
1x Suction gripper, 10 mm diameter	560158
1x Vacuum generator	548628
1x Single-acting cylinder	152887
2x Double-acting cylinder	152888
1x Driving/tractive load	152889
1x Pressure gauge	152865
1x Start-up valve with filter control valve	540691
1x Manifold	152896
2x Plastic tubing, 4 x 0.75 silver 10 m	151496

Accessories, order at the same time:

Aluminum profile plate → Page 11, 17	
Compressor → Page 132	

Also order:

Pneumatic Control Technology – Exercises for Trainees
Recommended and published by the Federal Institute for Vocational Training (BIBB).

In addition to 11 exercises from the Pneumatics equipment set of the Federal Institute for Vocational Training, the following topics are included:
– Compressed air generation
– Basic concepts of control technology
– Maintenance
– Servicing
– Inspections
– Repair procedure
– Troubleshooting/analysis/documentation

de	**90070**

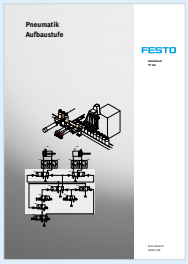
Pneumatic Control Technology – Exercises and Solutions
Recommended and published by the Federal Institute for Vocational Training (BIBB).

The trainees are asked various questions about the 11 exercises in the book “Control Technology Pneumatics, Exercises for the Trainee”. The document also contains the solutions with the circuit diagrams.

de	**90090**

Recommended learning materials

Workbook



Campus license (→ Page 167)

de	540671
en	541088
es	542503
fr	542507

eLearning courses
→ Basic Principles of Pneumatics



→ Simple Pneumatic Circuits
→ Pneumatic Actuators
→ Pneumatic Valves
→ Pneumatic Air Treatment

eLab course
→ Basics of Pneumatics

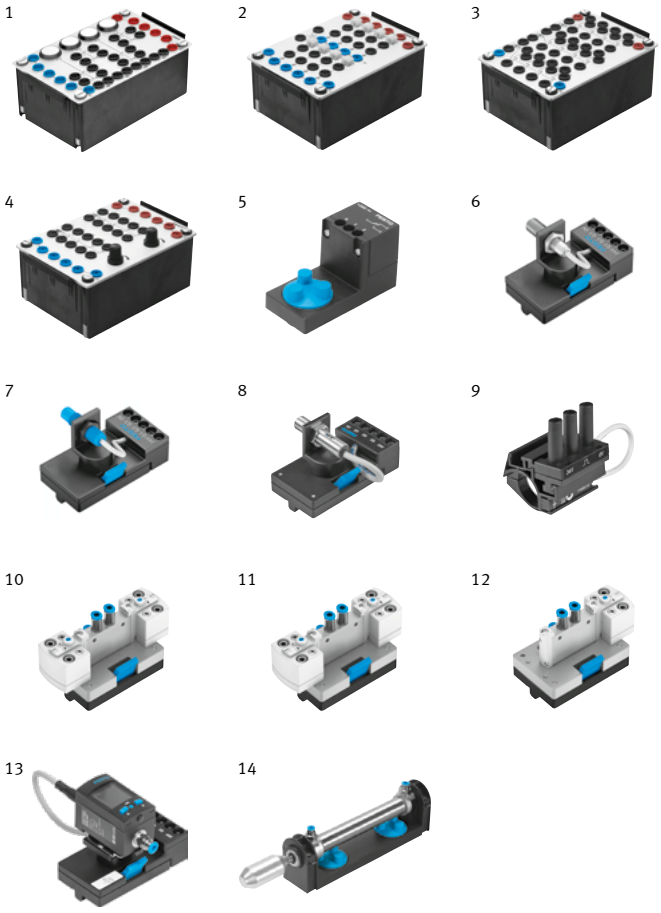
Evaluation
→ Basics of Pneumatics

Recommended simulation software
– FluidSIM Pneumatics
→ Page 168

Other learning materials
– Set of Posters on Pneumatics
→ Page 170

Suitable for the Electropneumatics course of the Federal Institute for Vocational Education and Training

Equipment Set for Electropneumatics from BIBB



Complete Equipment Set for Electropneumatics from BIBB in organizer	**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 3-way	162241
4	1x	Time relay, 2-way	162243
5	1x	Limit switch, electrical, left-actuated	183322
6	1x	Proximity switch, inductive, M12	548643
7	1x	Proximity switch, capacitive, M12	548651
8	1x	Proximity switch, optical, M12	572744
9	2x	Proximity switch, 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:

Aluminum profile plate → Page 11, 17
Compressor → Page 132
Tabletop power supply unit ➔ www.festo.com/didactic
Power supply unit for mounting frame → Page 158
4 mm safety laboratory cables → Page 159

Packed with the basics of electropneumatics!

The composition of the components of this equipment set is tailored to the training course of the Federal Institute for Vocational Education and Training (BIBB). The training documents and the equipment set provide basic training in electropneumatic control technology.

Objectives
- Physical basics of pneumatics and electrics
- Function and use of electropneumatic components
- Setting up controllers with relays
- Path-dependent controllers and sequence controllers
- Troubleshooting for extensive electropneumatic controllers

Benefits
- Industrial quality components
- Pneumatic connections are on top of the components and easily accessible
- Electrical connections via 4 mm safety sockets
- The control systems can be assembled virtually without any consumables or tools
- Everything is supplied in an organized equipment tray for systainer and drawer

Recommended learning material

eLearning Course
- Basic Electropneumatic Principles



- Basic Electropneumatic Circuits
- Electropneumatic Components

eLab Course
- Basics of Electropneumatics

Evaluation
- Basics of Electropneumatics

Recommended simulation software
- FluidSIM Pneumatics

Also order:
Federal Institute for Vocational Training Electropneumatics course

de	**93070**

Additionally:
Tasks, log sheets, exercise circuits

de	**93080**

Basics of Closed-Loop Pneumatics

Equipment Set TP 111

Complete Equipment Set TP 111 in organizer	**184467**

The most important components at a glance:

1x Signal input, electrical	162242
2x 3/2-way valve with pushbutton actuator, normally closed	152860
1x 2 x 3/2-way solenoid valve with LED, normally closed	567198
1x Pressure gauge	152865
2x One-way flow control valve	193967
1x Start-up valve with filter control valve, 5 µm	526337
1x Manifold	152896
1x Plastic tubing, 4 x 0.75 silver 10 m	151496
1x PID controller	162254
1x Comparator	8185562
1x Pressure sensor, analog	167094
1x 5/3-way solenoid valve, normally closed	567201
1x 5/3-way proportional valve	167078
2x Air reservoir, 0.4 l	152912
1x Status controller	162253
1x Linear drive, pneumatic, with guide and accessories	8211193
1x Linear potentiometer (displacement encoder)	152628
1x Ruler	525927
1x Weight, 5 kg, for linear drive	34065
2x Shock absorber	34572
1x Connecting cable for linear potentiometer	8201555
1x Adapter for Y-axis or weight	167032
1x Mounting accessories for position encoder	8201548

Recommended accessories:

Aluminum profile plate → Page 11, 17	
Compressor → Page 132	
Digital multimeter	8217596
Digital storage oscilloscope → Page 157	
Function generator	8222730
Cable BNC – 4 mm	8023959
Cable BNC – BNC	158357
T-piece BNC	159298
Tabletop power supply unit → www.festo.com/didactic	
Power supply unit for mounting frame → Page 158	
4 mm safety laboratory cables → Page 159	

Learning and further developing knowledge of closed-loop pneumatics

The Equipment Set TP 111 for Closed-Loop Pneumatics provides the necessary components for learning analog control technology. Pneumatic drives are controlled using electrical control and regulation elements. The focus is on pressure and position control. It optimally matches the training media that communicate clear project tasks.

Objectives
- Controlling pressure and position
- Operating sequence of a control loop
- Mode of operation and time response of control devices
- Behavior of controlled systems
- Interaction of regulators and controlled systems

Benefits
- Industrial quality components
- 5/3-way proportional valve
- Rodless cylinder with displacement encoder
- Everything is supplied in an organized equipment tray for systainer and drawer

Recommended learning materials

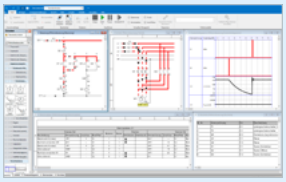
Workbook



Campus license (→ Page 167)

de	94459
en	94465
es	533499
fr	94347

Recommended simulation software
- FluidSIM Pneumatics
  → Page 168



Energy-Efficient Compressed Air Management
Equipment Set AirCS



Energy-Efficient Compressed Air Management

The topics of compressed air energy monitoring and compressor control are taught using a practical and comprehensive method.

As part of a continuous learning project, the exercises are divided into the topics condition monitoring, load management, long-term monitoring, flow resistance, and nominal flow measurement.

Results can be measured using measuring points, and then printed or exported to a spreadsheet program. In addition, the software includes the entire set of exercises as a PDF file. The languages (de/en) can be switched in the software.

The view of the overall system
Before compressed air can be used, it must be generated, processed, and distributed to the application. Compressed air is a valuable form of energy. The AirCS® EduTrainer is integrated between the compressed air generation (compressor) and the process. The integrated measurement technology, together with the FluidLab-AirCS software, enables innovative condition monitoring for measuring compressed air and power consumption.

Generation and load management
Different compressors are compared and changes are detected at an early stage. A calculation guide supports the calculation of the total variable and fixed costs of compressed air generation. The energy consumption of the compressor and another consumer is visualized together with the load management.

Distribution and monitoring
With long-term monitoring, it is possible to visualize the consumption of individual applications. Parts of the compressed air distribution can be examined in the Flow Resistance menu. In addition, a calculation aid is available to determine the ideal pipe cross-section.

Objectives
- Generation, preparation, and distribution of compressed air
- Condition monitoring
- Flow measurement and flow resistance
- Effect of leakages
- Pressure losses in distribution networks

Benefits
- Efficient compressed air applications
- Recording pneumatic and electrical consumption values
- FluidLab-AirCS license included
- Industrial quality components
- Can be used in an A4 mounting frame or on the lab table

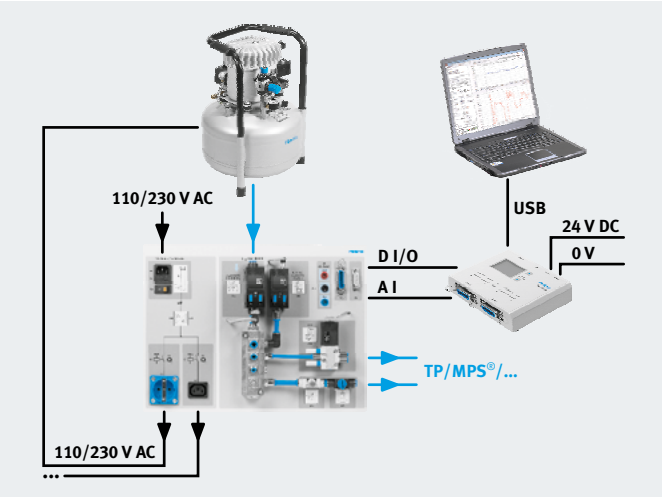
Complete Equipment Set AirCS	**8023858**

The most important components at a glance:

1x AirCS EduTrainer	8023859
1x AirCS accessory kit	8023860
1x FluidLab-AirCS 1.0 single license	8023861
1x EasyPort USB	548687
1x Analog cable, parallel, 2 m	529141
1x I/O data cable with SysLink plugs (IEEE 488), 2.5 m	34031
1x Pressure sensor with display	572745

Required accessories, order at the same time:

Compressor → Page 132
Tabletop power supply unit ➔ www.festo.com/didactic
Power supply unit for mounting frame → Page 158
4 mm safety laboratory cables → Page 159



Including FluidLab-AirCS
A key component of the AirCS equipment set is the FluidLab-AirCS software. The interface can be set up in a few simple steps and the user language (de/en) can be selected too. The exercises can then be started immediately.

Implementation is supported by connection diagrams, descriptions, and sample solutions from the AirCS workbook. The software also takes over the control of the measurement process. Results can be measured using measuring points, and then printed or exported to a spreadsheet program. The software also includes the entire workbook and worksheets as PDF files.

AirCS training course document
The accompanying document for the AirCS learning project is the workbook in German and English.

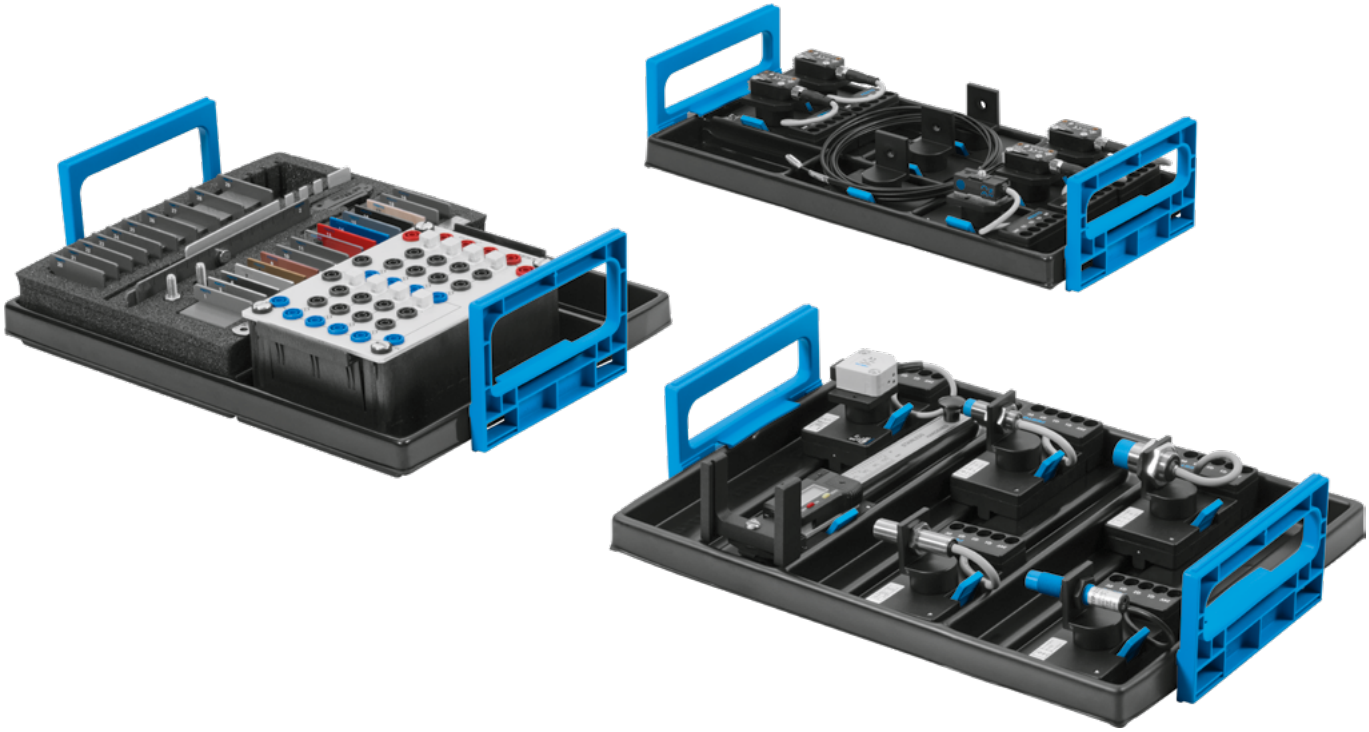
The workbook contains:
– Scope of the exercise
– Sample solutions
– Training notes

Up to two electrical loads (e.g., compressor and variable power supply) are required to perform the load management exercises.



Sensors for Object Detection

Equipment Set TP 1311



The sensory ability of automation technology

The Equipment Set TP 1311, Sensors for Object Detection, comprehensively covers the structure, function, and application areas of different sensors. Special attention is paid to the selection of sensors based on the requirements of an application.

The equipment set includes sensors with analog and binary output signals, whereby the focus is on binary output signals. These sensors are known as proximity switches. The following types are included in the equipment set: magnetic proximity switches, inductive proximity switches, optical proximity switches, capacitive proximity switches, and inductive sensors with analog output signal.

Without needing tools and using just one hand, the components can be flexibly arranged on a profile plate with 50 mm slot spacing or in an ER mounting frame to create a wide variety of pneumatic control systems. All electrical connections are located on the top of the components so they are easily accessible. The electrical components have 4 mm safety sockets. All components are of industrial quality.

The components are supplied in practical equipment trays. The equipment trays not only fit in the drawers of the laboratory furniture but also in a Systainer. Adhesive symbols for clearly labeling where components are stored in the equipment trays are included in the scope of delivery.

Objectives
- Magnetic, inductive, optical, and capacitive sensors
- Basics of connection and circuit technology
- Influence of workpiece parameters on switching behavior
- Logical linking of sensor signals
- Selection of suitable sensors for an application

Benefits
- Industrial quality components
- Sensors with binary and analog output signals
- Simple and secure placement of components with the Quick-Fix quick fastening system
- Electrical connections via 4 mm safety sockets
- Everything is supplied in an organized equipment tray for systainer and drawer

Complete Equipment Set TP 1311	**8150804**

The most important components at a glance:

1x Through-beam light barrier, transmitter, and receiver	8147646
1x Light guide	8147650
1x Fiber-optic unit	8147649
1x Indicator unit and distributor, electrical	162244
1x Proximity switch, inductive, M12	548643
1x Proximity switch, inductive, M18	548645
1x Proximity switch, capacitive, M12	548651
1x Proximity switch, magneto-resistive	566199
1x Set of test objects	549830
1x Reflector (triple mirror), 20 mm	8147645
1x Retro-reflective sensor	8147647
1x Diffuse sensor with background suppression	8147648
1x Slide unit	572740
1x Sensor, inductive, with analog output, M12	548644

Accessories, order at the same time:

Aluminum profile plate → Page 11, 17
Slotted mounting plate → Page 15, 17
Tabletop power supply unit ➔ www.festo.com/didactic
Power supply unit for mounting frame → Page 158
4 mm safety laboratory cables → Page 159

Recommended learning materials

Workbook



Campus license (→ Page 167)

de	8158730
en	8163545
es	8163546
fr	8163547

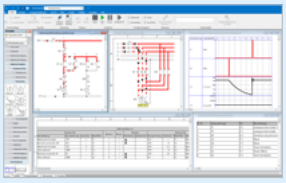
eLearning course

→ Sensors for Object Detection



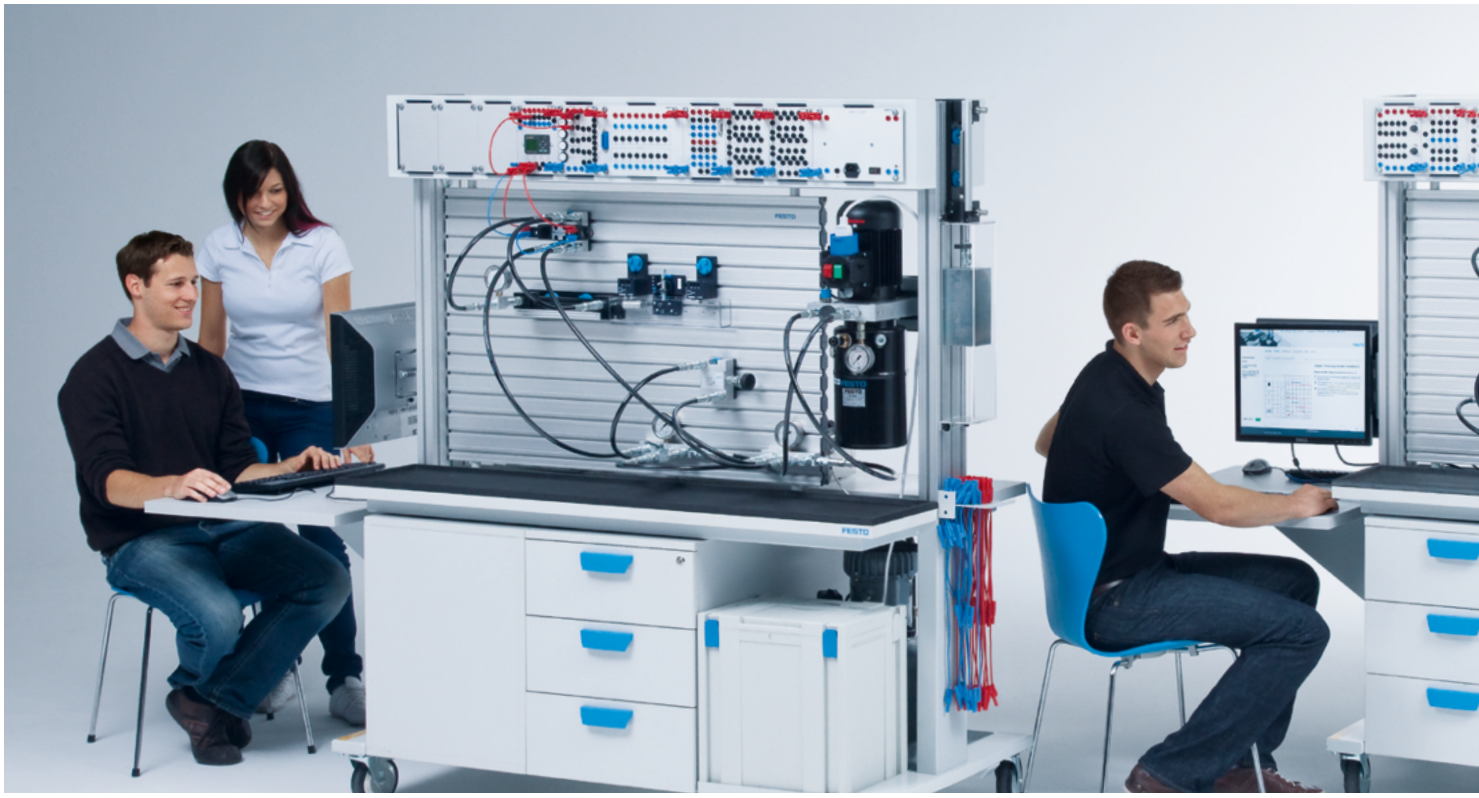
Recommended simulation software

– FluidSIM Pneumatics
→ Page 168



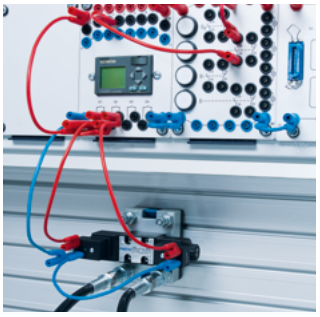
Hydraulics Training Packages

Customized Training for Industrial and Mobile Hydraulics



Modular, flexible, and expandable

The training packages from Festo Didactic have a modular structure. For example, you could start with the basic level of electrohydraulics and then move onto the advanced level. Or is the topic of electropneumatics interesting? The choice is yours. Would you like to train on a specific group of topics? All the components of the equipment sets can also be ordered separately so you can turn your own ideas into reality.



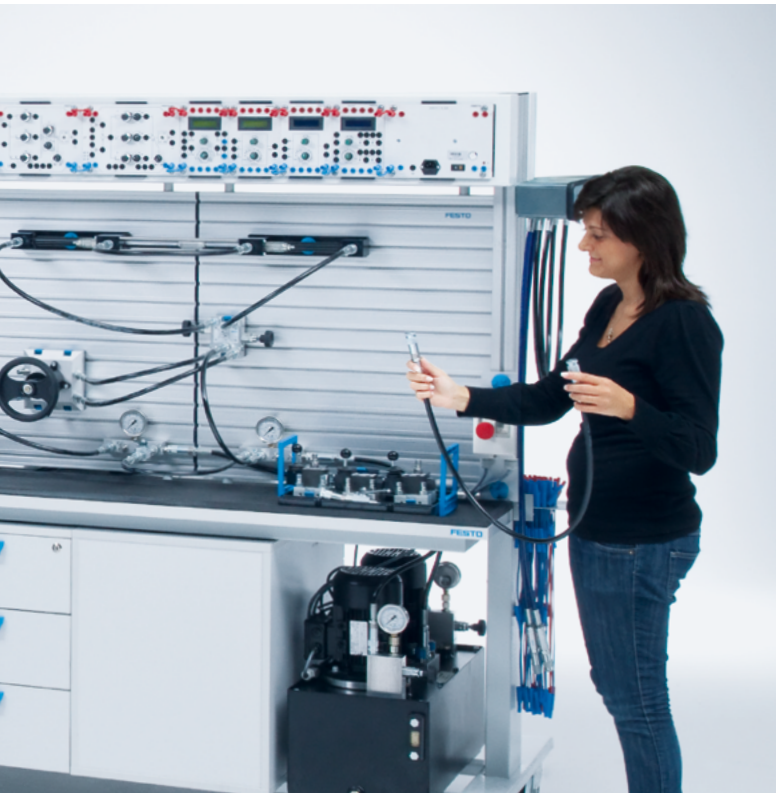
Position – clamp – done!
All the components are simply and securely attached to the profile plate, but also to the profile column of a Learnline workstation using the Quick-Fix quick fastening system. The electrical units are clamped into the ER frame and lined up individually. Both the carriers and the electrical units are of course the same for hydraulics and pneumatics – invest once, use twice.



Keep a clear and systematic overview!
Most equipment sets are supplied with an organizer that is compatible with a Systainer. This organizer fits into the drawers of the workstations. The large symbol label on the components, designed as per the current standard, provides an overview for how to correctly connect the components, and ensures short preparation and follow-up times. When dismantling the circuit, the component's place in the organizer is quick and easy to find again.



Plug in – connect – power!
The hydraulic power supply is provided by the tool-free connection of low-leakage couplings – the latest generation in stainless steel. The coupling is self-sealing when decoupled. During the smooth coupling process, only the end is wetted with oil. This saves resources, avoids environmental pollution, and reduces the ingress of dirt.



Didactic plus

The workbooks accompanying the training packages contain project-related exercises of increasing complexity. There are also layout sketches, illustrations, videos, cross-sectional drawings, and animations that show how things look in practice. To ensure the topic of hydraulics is covered fully and expertly, the training also covers basic physics, technical calculations, safety, efficiency, analytical fault finding and professional documentation.

Practical education and 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. By the way:, almost all hydraulic and electrical connections are on the top of the components so they are easily accessible.





Your choice of training environment
User-friendly training environments for specific topic areas:
– Self-study phases using the learning programs
– Design and documentation with FluidSIM
– Practical implementation with the training packages and the exercises in the workbooks
– Functional testing and optimization using measurement technology and FluidLab



Class instead of mass!
Bigger is not better. Volume flow rates and pressures should be selected sensibly and in line with the overall system. This applies in particular to hydraulic systems in training. High forces and cylinder speeds not only increase the risk to the user, but also require a larger hydraulic power unit with higher power consumption. As big as necessary and as small as possible, without compromising on the training, that's what we offer.

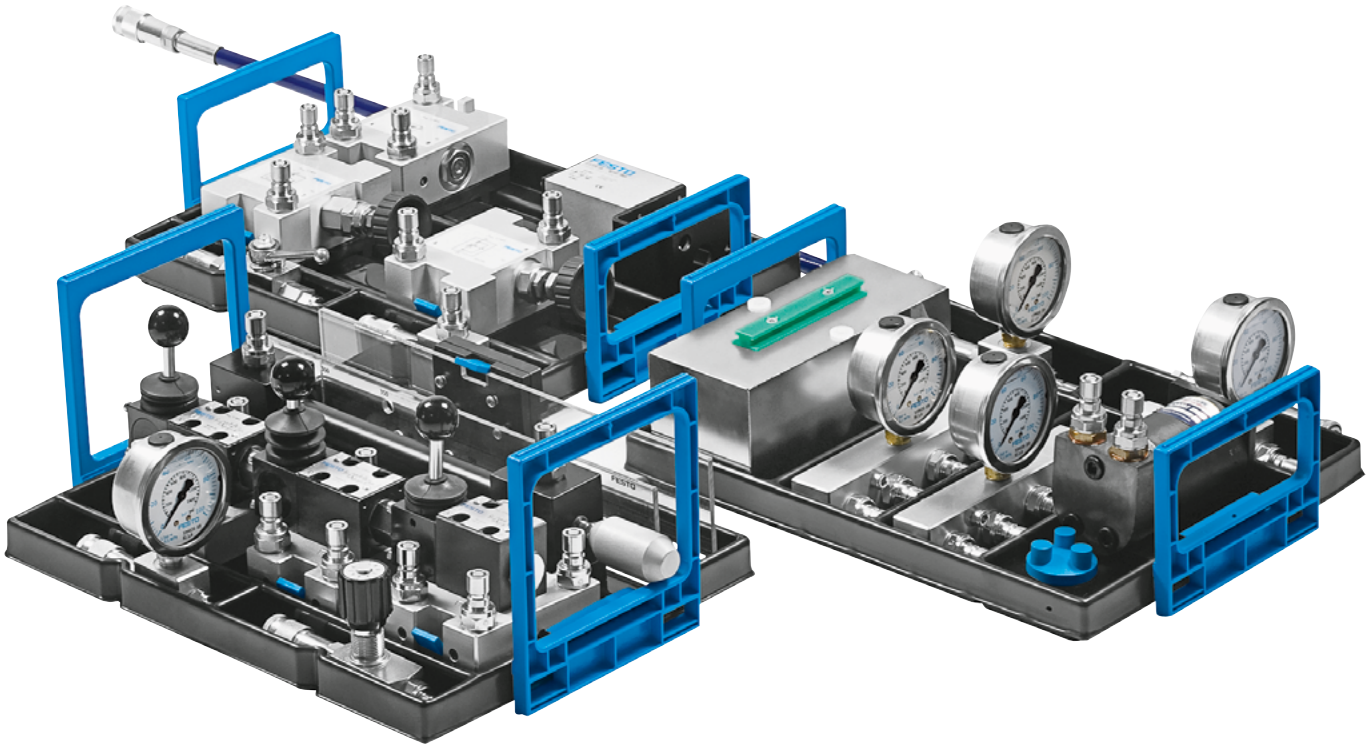


New technologies – new training requirements
Modern measuring and diagnostic technology, as well as cartridge and built-in valves are among the international trends in hydraulics. That is why these technologies can also be found in our learning systems. Take advantage of the compact, integrated design, low weight, easy handling, and clear symbols.



Mobile hydraulics
The mobile hydraulics training packages have a systematic and comprehensible way to teach complex topics and systems, such as working hydraulics, hydrostatic steering and drive systems for the agricultural, forestry, and construction machinery sector, as well as industrial trucks and municipal vehicles.

Hydraulics Basic Level
Equipment Set TP 501



The solid foundation for practice-oriented education and training in hydraulic control technology

Basic Hydraulics Equipment Set TP 501 teaches the basics of hydraulic control technology. It provides an understanding of basic physical principles of hydraulics, as well as how hydraulic components work and are used. Simple hydraulic controllers can be set up with the equipment set.

The number and design of the components of the equipment set and the projects of the training media are optimally coordinated. This makes for effortless teaching of the essential basics.

Without needing tools and using just one hand, the components can be flexibly arranged on a profile plate with 50 mm slot spacing. All hydraulic and electrical connections are on the top of the components so they are easily accessible. The hydraulic connection is made without tools using low-leakage stainless steel couplings. The coupling nipple and coupling socket are self-sealing when uncoupled and are pressure-resistant up to 12 MPa. Sensors for pressure, temperature, and flow can be used at any coupling point. The electrical components have 4 mm safety sockets or M8/M12 industrial connectors. All components are of industrial quality.

The components are supplied in practical equipment trays. The equipment trays not only fit in the drawers of the laboratory furniture, but also in a Systainer. Adhesive symbols for clearly labeling where components are stored in the equipment trays are included in the scope of delivery.

Objectives
- Physical basics of hydraulics
- Simple hydraulic controllers
- Design and function of hydraulic components
- Calculating typical values, e.g., force, piston diameter, pressure
- Measuring characteristic curves

Advantages
- Flexible extension options
- Tool-free hydraulic connection with low-leakage couplings
- Coupling nipple and coupling socket, self-sealing in uncoupled state
- Industrial quality components
- Supplied in an organized equipment tray for systainer and drawer

Complete Equipment Set TP 501 in organizer	**573035**

The most important components at a glance:

1x	Pressure relief valve	544335
1x	2-way flow control valve	544338
1x	One-way flow control valve	152843
1x	Non-return valve, piloted	544339
1x	Non-return valve, 0.6 MPa valve opening pressure	548618
1x	4/2-way hand lever valve, spring return	544342
1x	4/3-way hand lever valve, relieving mid-position (AB–>T), detenting	544344
1x	4/3-way hand lever valve, closed mid-position, detenting	544343
1x	Shut-off valve	152844
1x	Differential cylinder 16/10/200 with cover	572746
1x	Weight, 9 kg for cylinder	152972
1x	Hydraulic motor	152858
1x	T-distributor	152847
2x	4-way distributor with pressure gauge	159395
3x	Pressure gauge	152841
1x	Flow sensor	567191

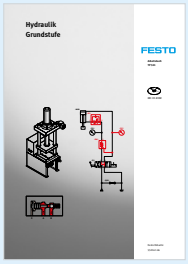
Required accessories, order at the same time:

7x	Hose line with quick connection couplings, 600 mm	152960
3x	Hose line with quick connection couplings, 1000 mm	152970
2x	Hose line with quick connection couplings, 1500 mm	159386
	Digital multimeter	8217596
	Aluminum profile plate → Page 11, 17	
	Hydraulic power unit → Page 148	
	Cover for weight, 9 kg → Page 143	
	Power supply unit for mounting frame → Page 158	



Recommended learning materials

Workbook



Campus license (→ Page 167)

de	550141
en	551141
es	551145
fr	551146

eLearning courses

→ Basic Principles of Hydraulics
→ Simple Hydraulic Circuits
→ Hydraulic Power Units



→ Hydraulic Actuators
→ Hydraulic Valves

eLab course

→ Basic Principles of Hydraulics



Test center

→ Basic Principles of Hydraulics

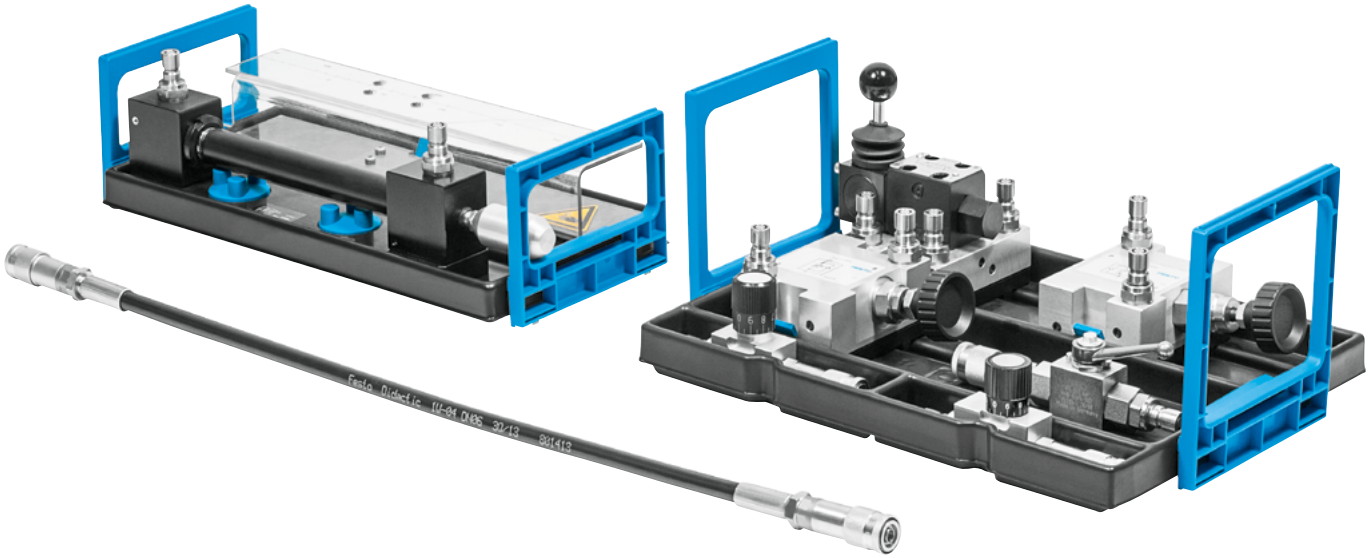
Recommended simulation software

– FluidSIM Hydraulics
→ Page 168

Other learning materials

– Set of Posters on Hydraulics
→ page 171

Systematic Troubleshooting
Equipment Set TP 501+



Systematic troubleshooting and competent fault rectification

Components with specific, realistic faults are included in the Systematic Troubleshooting Equipment Set TP 501+. This is how hydraulic control systems can be set up using the components of the Basic Hydraulics Equipment Set (TP 501), and individual components can be replaced with faulty ones. This makes teaching and learning about systematic troubleshooting professional and realistic.

Each component of the equipment set is accompanied by a detailed description and instructions for systematic troubleshooting. This allows the basics of systematic troubleshooting to be taught.

Without needing tools and using just one hand, the components can be flexibly arranged on a profile plate with 50 mm slot spacing. All hydraulic and electrical connections are on the top of the components so they are easily accessible. The hydraulic connection is made without tools using low-leakage stainless steel couplings. The coupling nipple and coupling socket are self-sealing when uncoupled and are pressure-resistant up to 12 MPa. Sensors for pressure, temperature, and flow can be used at any coupling point.

The electrical components have 4 mm safety sockets or M8/M12 industrial connectors. All components are of industrial quality.

The components are supplied in practical equipment trays. The equipment trays not only fit in the drawers of the laboratory furniture, but also in a Systainer. Adhesive symbols for clearly labeling where components are stored in the equipment trays are included in the scope of delivery.

Components from the Equipment Set TP 501 for Basic Level Hydraulics are required to carry out the project tasks.

Objectives
- Systematic troubleshooting in hydraulic controllers
- Locating and rectifying faults
- Optimizing controllers through error analysis

Advantages
- Components with predefined, realistic errors
- Errors observable without special measurement technology
- Supplied in an organized equipment tray for systainer and drawer

Complete Equipment Set TP 501+ in organizer	**8060229**

The most important components at a glance:

1x Shut-off valve, defective	8065301
1x One-way flow control valve, defective	8065298
1x Pressure relief valve, defective	8065175
1x 2-way flow control valve, defective	8065174
1x 4/3-way hand lever valve, H mid-position (PTAB), detenting	8065281
1x Flow control valve	152842
1x Differential cylinder 16/10/200, defective	8065195
1x Hose line with quick release couplings, clogged	8065327

Accessories, order at the same time

Aluminum profile plate → Page 11, 17
Hydraulic power unit → Page 148



Recommended learning materials

eLearning courses

→ Basic Principles of Hydraulics



→ Simple Hydraulic Circuits
→ Hydraulic Actuators
→ Hydraulic Valves



→ Hydraulic Power Units

eLab course

→ Basic Principles of Hydraulics



Test center

→ Basic Principles of Hydraulics

Recommended simulation software

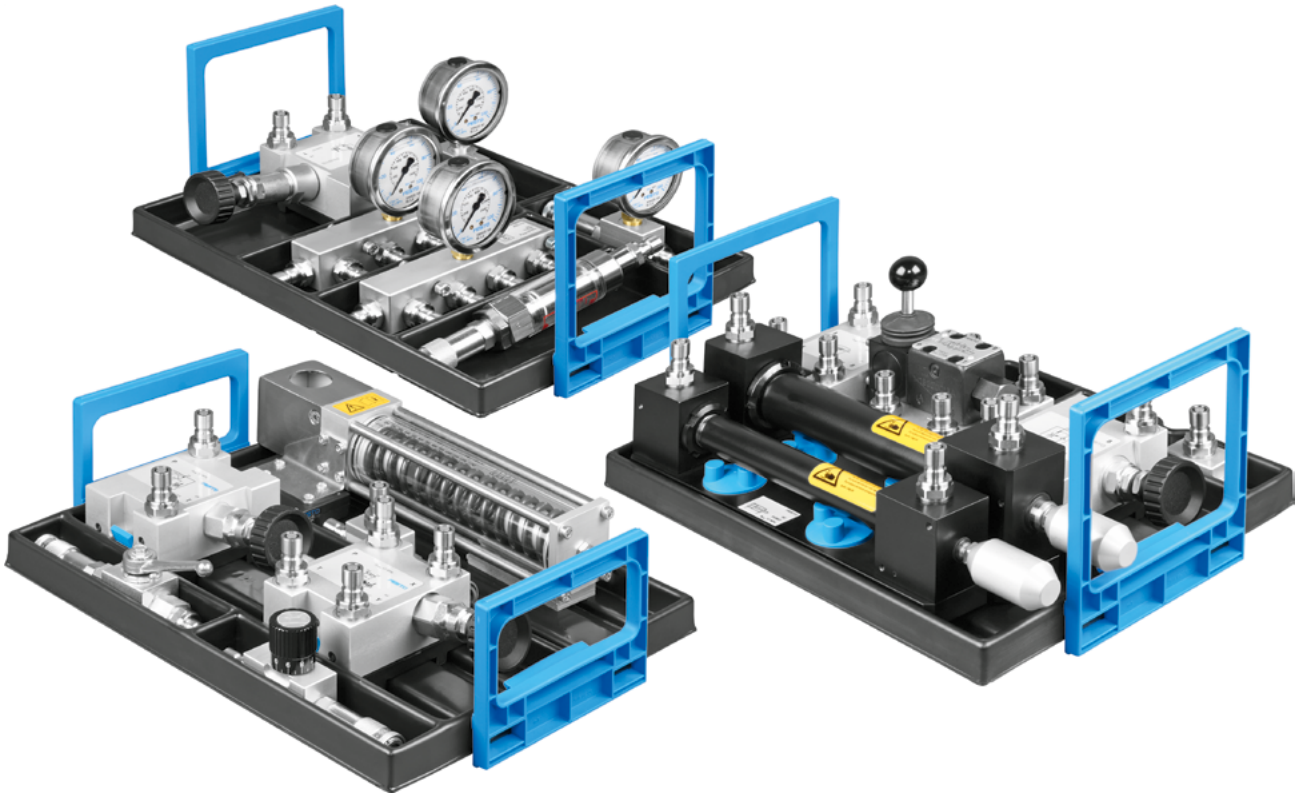
– FluidSIM Hydraulics
→ Page 168

Other learning materials

– Set of Posters on Hydraulics
→ page 171

Basic Hydraulics America

Equipment Set TP 501 America



Hydraulic training with US units and as per the NEMA standard.

Teach future professionals the basics of hydraulics with the new successor to the well-known Lab-Volt hydraulics equipment sets.

Objectives
- Simple hydraulic controllers
- Design and function of hydraulic components
- Calculating typical values, e.g., force, piston diameter, pressure
- Measuring characteristic curves
- Hydraulic pumps and efficient oil reservoirs

Complete Equipment Set TP 501 – America in organizer	**8060227**

The most important components at a glance:

1x	Differential cylinder 16/10/200 with cover	572746
1x	Differential cylinder 25/18/200 with cover	572747
1x	2-way flow control valve	544338
1x	4/3-way hand lever valve, mid-position closed, detenting	544343
1x	Non-return valve, unlockable	544339
1x	Shut-off valve	152844
1x	One-way flow control valve	152843
1x	Pressure relief valve	544335
1x	Pressure relief valve, piloted	8025067
1x	Spring load for cylinders, hydraulic	4914138
1x	Flow indicator with float	4857121
1x	3-way pressure reducing valve	544337
2x	4-way distributor with pressure gauge	159395
2x	Pressure gauge	152841
4x	T-distributor	152847

Required accessories, order at the same time:

8x	Hose line with quick connection coupling, 600 mm	152960
4x	Hose line with quick connection couplings, 1000 mm	152970
4x	Hose line with quick connection coupling, 1500 mm	159386
1x	Digital multimeter	8217596
	Workstation systems → Page 14 – 17	
	Hydraulic power unit → Page 148	
1x	Power supply unit for mounting frame (NEMA 5-15 plug)	162411

Recommended learning materials

Workbook



Campus license (→ Page 167)

en	793157

eLearning courses

→ Basic Principles of Hydraulics
→ Simple Hydraulic Circuits
→ Hydraulic Actuators



→ Hydraulic Valves
→ Hydraulic Power Units

eLab course

→ Hydraulics Basic Level - TP America



Test center

→ Basic Principles of Hydraulics

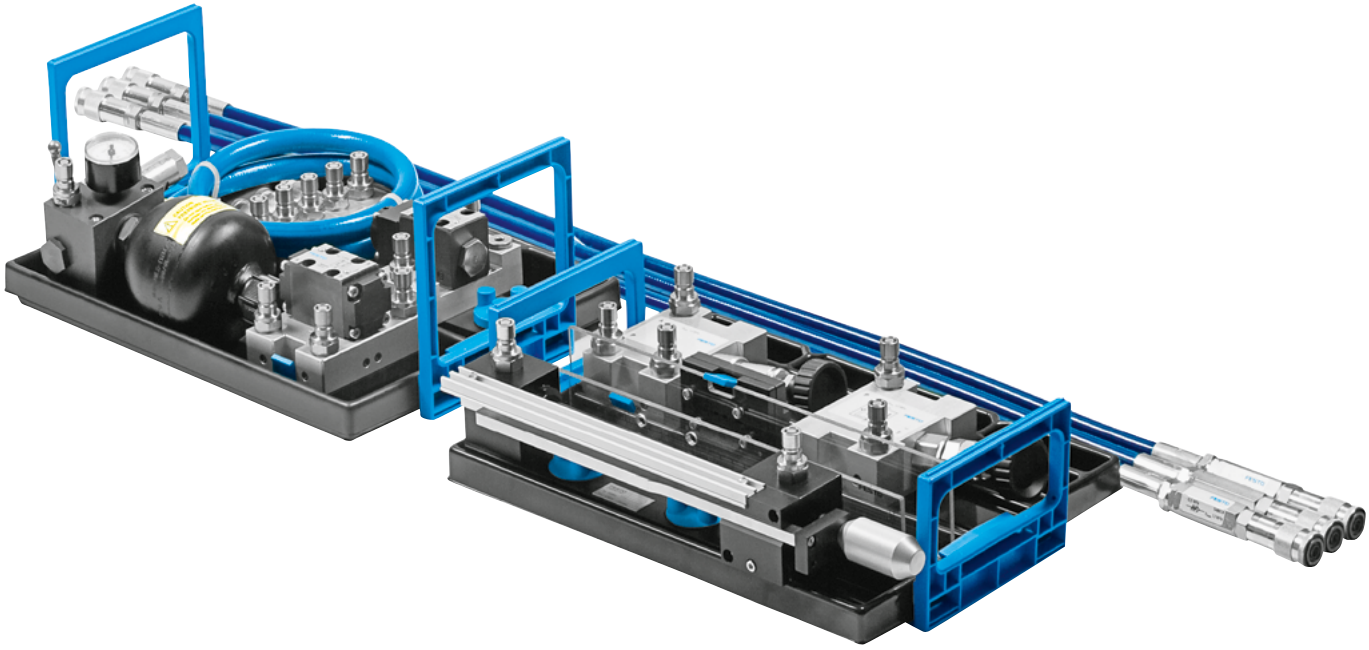
Recommended simulation software

– FluidSIM Hydraulics
→ Page 168

Other learning materials

– Set of Posters on Hydraulics
→ page 171

Advanced Hydraulics
Equipment Set TP 502



Hydraulics for advanced students

Knowledge of the physical principles of hydraulics is extended with the Advanced Hydraulics Equipment Set TP 502. The design, function, and use of other hydraulic components are explained.

The number and design of the components of the equipment set and the projects of the training media are optimally coordinated. This means that teaching the contents of the extensive hydraulic control systems at the advanced level is effortless.

Without needing tools and using just one hand, the components can be flexibly arranged on a profile plate with 50 mm slot spacing. All hydraulic and electrical connections are on the top of the components so they are easily accessible. The hydraulic connection is made without tools using low-leakage stainless steel couplings. The coupling nipple and coupling socket are self-sealing when uncoupled and are pressure-resistant up to 12 MPa. Sensors for pressure, temperature, and flow can be used at any coupling point.

The electrical components have 4 mm safety sockets or M8/M12 industrial connectors. All components are of industrial quality.

The components are supplied in practical equipment trays. The equipment trays not only fit in the drawers of the laboratory furniture, but also in a Systainer. Adhesive symbols for clearly labeling where components are stored in the equipment trays are included in the scope of delivery.

Components from the Basic Hydraulics Equipment Set (TP 501) are required to carry out the project tasks.

Objectives
- Extensive hydraulic controllers
- Design, function, and use of hydraulic motors, diaphragm accumulators, and pressure-reducing valves
- Calculate power balances of hydraulic controllers
- Sequence descriptions with GRAFCET

Advantages
- Simple and secure placement of components with the Quick-Fix quick fastening system
- Tool-free hydraulic connection with low-leakage couplings
- Coupling nipple and coupling socket, self-sealing in uncoupled state
- Industrial quality components
- Supplied in an organized equipment tray for systainer and drawer

Complete Equipment Set TP 502 in organizer	**573036**

The most important components at a glance:

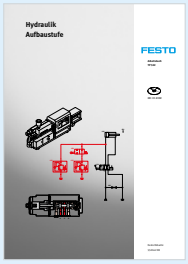
1x	Pressure relief valve, compensated	567237
1x	3-way pressure reducing valve	544337
1x	Flow dividing valve	544340
1x	2/2-way stem actuated valve, convertible	544353
3x	Non-return valve, 0.6 MPa opening pressure	548618
1x	Diaphragm accumulator with shut-off block	152859
1x	Differential cylinder 16/10/200 with cover	572746
1x	Mounting kit for cylinders	544371
5x	T-distributor	152847

Required accessories, order at the same time:

7x	Hose line with quick connection couplings, 600 mm	152960
4x	Hose line with quick connection couplings, 1000 mm	152970
2x	Hose line with quick connection couplings, 1500 mm	159386
	4 mm safety laboratory cables → Page 159	
	Digital multimeter	8217596
	Aluminum profile plate → Page 11, 17	
	Hydraulic power unit → Page 148	
	Cover for weight, 9 kg → Page 143	
	Power supply unit for mounting frame → Page 158	

Recommended learning materials

Workbook



Campus license (→ Page 167)

de	550142
en	551147
es	551148
fr	551149

eLearning course

→ Basic Principles of Hydraulics



→ Simple Hydraulic Circuits
→ Hydraulic Actuators



→ Hydraulic Valves
→ Hydraulic Power Units

Recommended simulation software

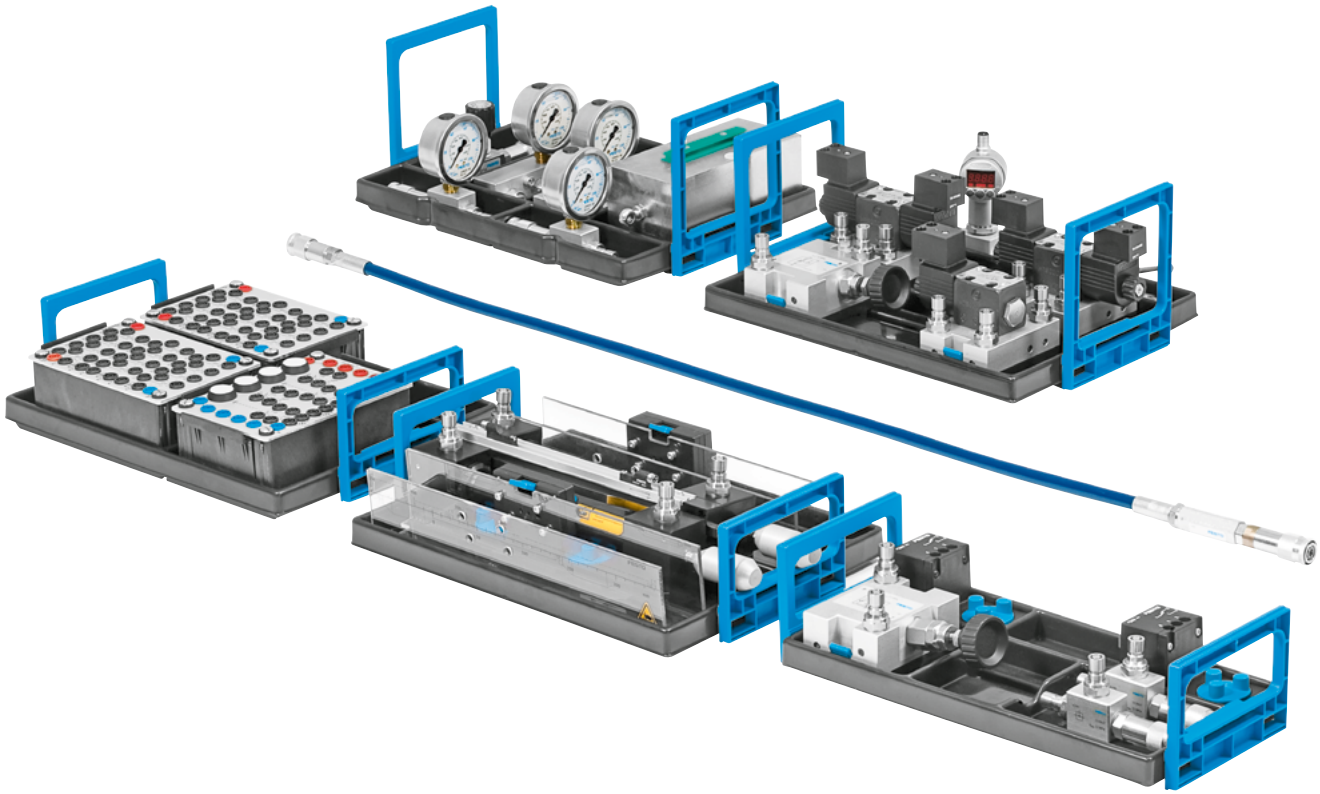
– FluidSIM Hydraulics
→ Page 168

Other learning materials

– Set of Posters on Hydraulics
→ page 171

Basic Electrohydraulics

Equipment Set TP 601



The most important basics of electrohydraulic control technology in a compact form

Basic Electrohydraulics Equipment Set TP 601 is suitable for basic training in electrohydraulic control technology. On the basis of practical problem descriptions, the training media impart knowledge about the basic physical principles of electrohydraulics, function, and use of electrohydraulic components and typical, basic electrical circuits. A basic knowledge of hydraulic device technology is a prerequisite.

The number and design of the components of the equipment set and the projects of the training media are optimally coordinated. This makes for effortless teaching of the essential basics.

Without needing tools and using just one hand, the components can be flexibly arranged on a profile plate with 50 mm slot spacing or in an ER mounting frame to create a wide variety of pneumatic control systems. All hydraulic and electrical connections are on the top of the components so they are easily accessible. The hydraulic connection is made without tools using low-leakage stainless steel couplings. The coupling nipple and coupling socket are self-sealing when uncoupled and are pressure-resistant up to 12 MPa. Sensors for pressure, temperature, and flow can be used at any coupling point.

The electrical components have 4 mm safety sockets or M8/M12 industrial connectors. All components are of industrial quality.

The components are supplied in practical equipment trays. The equipment trays not only fit in the drawers of the laboratory furniture, but also in a Systainer. Adhesive symbols for clearly labeling where components are stored in the equipment trays are included in the scope of delivery.

Objectives
- Designing simple electrohydraulic controllers
- Design, function, and use of electrohydraulic components
- Design, function, and use of electrical switches, limit switches and relays
- Basic logic functions and latch circuits
- Systematic troubleshooting and fault rectification

Advantages
- Industrial quality components
- Tool-free hydraulic connection with low-leakage couplings
- Connection of the solenoid coils via 4 mm safety sockets
- Electrical control unit with relay
- Supplied in an organized equipment tray for systainer and drawer

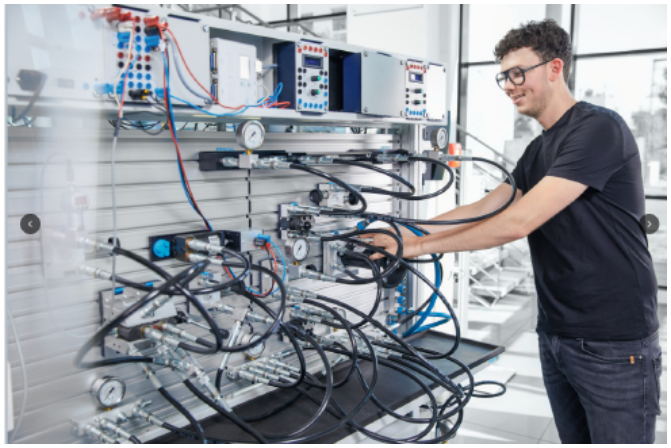
Complete Equipment Set TP 601 in organizer	**573037**

The most important components at a glance:

1x	Pressure relief valve	544335
1x	2-way flow control valve	544338
1x	One-way flow control valve	152843
1x	Non-return valve, 0.6 MPa opening pressure	548618
1x	4/2-way solenoid valve, spring return	544346
1x	4/3-way solenoid valve, mid-position closed	544347
1x	4/2-way double solenoid valve, detenting	544352
1x	Shut-off valve	152844
1x	Weight, 9 kg for cylinder	152972
2x	Differential cylinder 16/10/200 with cover	572746
1x	Mounting kit for cylinders	544371
2x	T-distributor	152847
2x	4-way distributor with pressure gauge	159395
2x	Pressure gauge	152841
1x	Pressure switch, electronic	548612
2x	Relay, 3-way	162241
1x	Signal input, electrical	162242
1x	Limit switch, electrical, left-actuated	183322
1x	Limit switch, electrical, right-actuated	183345
2x	Proximity switch, electronic	2342009

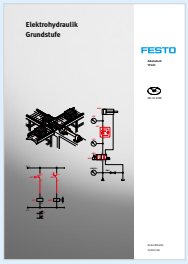
Required accessories, order at the same time:

7x	Hose line with quick connection couplings, 600 mm	152960
2x	Hose line with quick connection coupling, 1000 mm	152970
4x	Hose line with quick connection coupling, 1500 mm	159386
	4 mm safety laboratory cables → Page 159	
	Digital multimeter	8217596
	Aluminum profile plate → Page 11, 17	
	Hydraulic power unit → Page 148	
	Cover for weight, 9 kg → Page 143	
	Tabletop power supply unit → www.festo.com/didactic	
	Power supply unit for mounting frame → Page 158	



Recommended learning materials

Workbook



Campus license (→ Page 167)

de	550143
en	551150
es	551151
fr	551152

eLearning course

→ Basic Principles of Electrohydraulics



→ Electrohydraulic Components
→ Basic Electrohydraulic Circuits

eLab course

→ Basics of Electrohydraulics



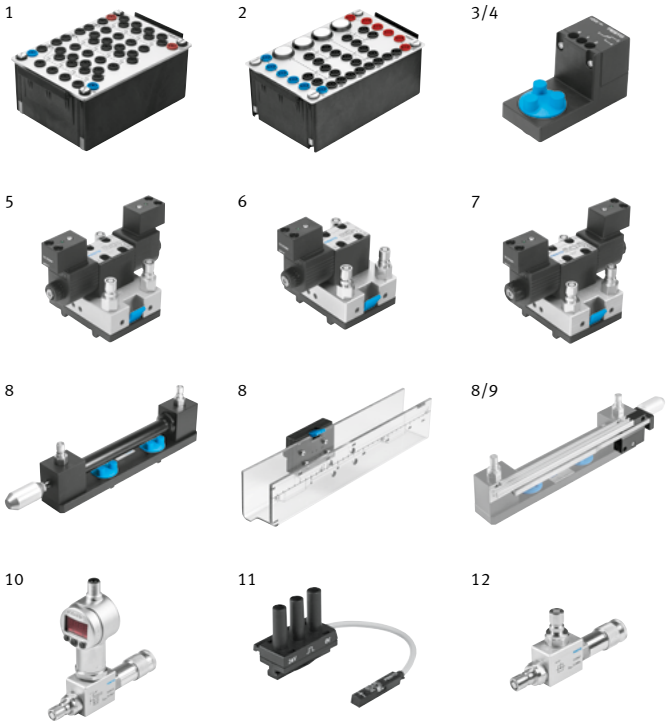
Test center

→ Basics of Electrohydraulics

Recommended simulation software

– FluidSIM Hydraulics
→ Page 168

Electrohydraulics
Supplementary Equipment Sets



Hydraulics Basic Level to Electrohydraulics Basic Level
Supplementary Equipment Set TP 501 – TP 601

You have the Hydraulics Basic Level Equipment Set TP 501. With the supplementary equipment set, you can extend the range of functions to the complete Electrohydraulics Basic Level Equipment Set TP 601.

Objectives
- Designing simple electrohydraulic controllers
- Design, function, and use of electrohydraulic components
- Design, function, and use of electrical switches, limit switches and relays
- Basic logic functions and latch circuits
- Systematic troubleshooting and fault rectification

Advantages
- Industrial quality components
- Supplements the Hydraulics Basic Level Equipment Set to form a complete Electrohydraulics Basic Level Equipment Set
- Tool-free hydraulic connection with low-leakage couplings
- Connection of the solenoid coils via 4 mm safety sockets
- Electrical control unit with relay
- Supplied in an organized equipment tray for systainer and drawer

Complete Supplementary Equipment Set TP 501 – TP 601	**573039**

The most important components at a glance:

1	2x	Relay, 3-way	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 switch, electronic	2342009
12	1x	T-distributor	152847

Hydraulics Advanced Level to Electrohydraulics Basic Level
Supplementary Equipment Set TP 502 – TP 601

You are already using the equipment sets Hydraulics Basic Level, TP 501, and Hydraulics Advanced Level, TP 502, in your training. With the supplementary equipment set, you can extend the range of functions to the complete equipment set for Electrohydraulics Basic Level TP 601.

For the **learning objectives** and **advantages**, see the Electrohydraulics Basic Level Equipment Set TP 601.

Complete Supplementary Equipment Set TP 502 – TP 601	**573040**

The most important components at a glance:

1	2x	Relay, 3-way	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 switch, electronic	2342009

Controllers for Electrohydraulics
Equipment Set Expansions

Equipment Set Expansion TP 601 Control with FluidSIM/EasyPort USB

The expanded equipment set for controlling TP 601 with FluidSIM/EasyPort USB offers the option of creating control programs as logic programs. These logic programs can be used to control simple automation processes. The process interface EasyPort USB is the interface for transmitting the process signals between a real control process and FluidSIM.

Objectives
- Logic programming with FluidSIM
- Controlling electropneumatic and electrohydraulic processes
- Replacing relay controllers

Advantages
- Extended application possibilities of FluidSIM
- FluidSIM controls the process via EasyPort USB
- FluidSIM P for electropneumatic controllers
- FluidSIM H for electrohydraulic controllers

1


2


3


4


5


Complete Supplementary Equipment Set for TP 601 FluidSIM/EasyPort	
in organizer	**556270**

The most important components at a glance:

1	1x Brief instructions for FluidSIM	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 plugs (IEEE 488), 2.5 m	34031

Prerequisite:

Equipment Set TP 601 → Page 84
FluidSIM Hydraulics → Page 168

Required accessories, order at the same time:

Aluminum profile plate → Page 11, 17
Hydraulic power unit → Page 148
Tabletop power supply unit → www.festo.com/didactic
Power supply unit for mounting frame → Page 158
4 mm safety laboratory cables → Page 159

Equipment Set Expansion TP 601 Control with LOGO!

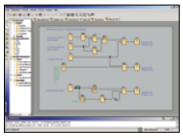
With the LOGO! 8 TP EduTrainer expanded equipment set, you get a compact mini control system with integrated connection technology for 4 mm safety plugs, allowing electrical components of the Festo Didactic equipment sets to be directly connected. This supplementary equipment set is used to implement simple automation projects.

Objectives
- Advantages of mini control systems
- Controlling electropneumatic and electrohydraulic processes
- Replacing relay controllers
- Using programming software

Advantages
- Link between relay/contactor controllers and programmable logic controllers
- Logic programming with a mini control system
- Siemens LOGO! 8 and LOGO! Soft Comfort

6


7


8


9


Complete Supplementary Equipment Set TP 601 Control with LOGO!	
In organizer	**8049517**

The most important components at a glance:

6	1x Brief instructions for LOGO!, de/en/es/fr	8049519
7	1x LOGO! 8 TP EduTrainer Compact TP	8040886
8	1x LOGO! Soft Comfort, de/en/es/fr	8040050
9	1x Ethernet cable	567280

Prerequisite:

Equipment Set TP 601 → Page 84

Required accessories, also order:

Aluminum profile plate → Page 11, 17
Hydraulic power unit → Page 148
Tabletop power supply unit → www.festo.com/didactic
Power supply unit for mounting frame → Page 158
4 mm safety laboratory cables → Page 159

You can find more controllers that suit your requirements at → www.festo.com/didactic, keyword “online configurator”

Hydraulics Basic Level to Electrohydraulics Basic Level America

Supplementary Equipment Set TP 501 America – TP 601 America



Electrohydraulic training with US units and as per the NEMA standard.

Teach future professionals the basics of electrohydraulics with the new successor to the well-known Lab-Volt electrohydraulic equipment sets.

Objectives

- Designing simple electrohydraulic controllers
- Design, function, and use of electrohydraulic components
- Design, function, and use of electrical switches, limit switches and relays
- Basic logic functions and latch circuits
- Recognizing and explaining circuit symbols of electrical and electrohydraulic component systems

Complete Supplementary Equipment Set TP 501 A – TP 601 A in organizer	**8233559**

The most important components at a glance:

1x	Flow dividing valve	544340
1x	4/2-way solenoid valve, spring return	544346
1x	4/3-way solenoid valve, bypass mid-position (P – T)	544349
1x	Mounting kit for cylinders	544373
1x	Hydraulic motor	152858
1x	Pressure switch, electronic	548612
1x	Flow sensor	567191
1x	Signal input, electrical	8062950
1x	Time relay, 2-way	8062960
1x	Proximity switch, optical, M12	8062967
1x	Limit switch, electrical, left-actuated	183322
1x	Limit switch, electrical, right-actuated	183345
2x	Relay, 3-way	8062958
2x	Proximity switch, electronic	2342009

Required accessories, order at the same time:

8x	Hose line with quick connection coupling, 600 mm	152960
4x	Hose line with quick connection couplings, 1000 mm	152970
4x	Hose line with quick connection coupling, 1500 mm	159386
1x	4 mm safety laboratory cables, 106 pieces, red, blue, and black	8092668
1x	Digital multimeter	8217596
	Workstation systems → Page 14 – 17	
	Hydraulic power unit → Page 148	
1x	Power supply unit for mounting frame (NEMA 5-15 plug)	162411

Only required when upgrading to TP 610

1x	4/3-way solenoid valve, closed mid-position	544347

Recommended learning materials

Workbook



Campus license (→ Page 167)

en	8233637

eLearning courses

→ Basic Principles of Electrohydraulics

→ Electrohydraulic Components



→ Basic Electrohydraulic Circuits

eLab course

→ Basic Electrohydraulics – TP America



Recommended simulation software

– FluidSIM Hydraulics
→ Page 168

Other learning materials

– Set of Posters on Hydraulics
→ page 171

Advanced Electrohydraulics

Equipment Set TP 602



Electrohydraulics for advanced users

The Electrohydraulics Advanced Level Equipment Set TP 602 provides advanced knowledge of the physical basics of electrics and electrohydraulics. The structure and function of additional components are also explained. And these components are being integrated in electrohydraulic control systems.

The number and design of the components of the equipment set and the projects of the training media are optimally coordinated. This means that the contents of the extensive electrohydraulic control systems of the advanced level can be taught with little effort.

Without needing tools and using just one hand, the components can be flexibly arranged on a profile plate with 50 mm slot spacing or in an ER mounting frame. All hydraulic and electrical connections are on the top of the components so they are easily accessible. The hydraulic connection is made without tools using low-leakage stainless steel couplings. The coupling nipple and coupling socket are self-sealing when uncoupled and are pressure-resistant up to 12 MPa. Sensors for pressure, temperature, and flow can be used at any coupling point.

The electrical components have 4 mm safety sockets or M8/M12 industrial connectors. All components are of industrial quality.

The components are supplied in practical equipment trays. The equipment trays not only fit in the drawers of the laboratory furniture, but also in a Systainer. Adhesive symbols for clearly labeling where components are stored in the equipment trays are included in the scope of delivery.

The components from the Electrohydraulics Basic Level Equipment Set TP 601 are required to carry out the project tasks.

Objectives
- Extensive electrohydraulic controllers
- Operating modes and safety functions
- Electrohydraulic controllers with timers
- Pressure sequence controllers

Advantages
- Industrial quality components
- Tool-free hydraulic connection with low-leakage couplings
- Connection of the solenoid coils via 4 mm safety sockets
- Supplied in an organized equipment tray for systainer and drawer

Complete Equipment Set TP 602 in organizer	**8233556**

The most important components at a glance:

1x	Time relay, 2-way	162243
2x	Relay, 3-way	162241
1x	Diaphragm accumulator with shut-off block	152859
1x	Hydraulic motor	152858
1x	4/3-way solenoid valve, relieving mid-position (AB –> T)	544348
1x	Proximity switch, inductive, M12	548643
1x	Emergency stop button, electrical	183347
1x	T-distributor	152847
1x	Non-return valve, piloted	544339
1x	Pressure relief valve, compensated	567237

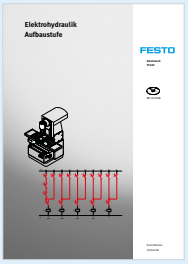
Required accessories, order at the same time:

8x	Hose line with quick connection coupling, 600 mm	152960
4x	Hose line with quick connection couplings, 1000 mm	152970
2x	Hose line with quick connection couplings, 1500 mm	159386
	4 mm safety laboratory cables → Page 159	
	Digital multimeter	8217596
	Aluminum profile plate → Page 11, 17	
	Hydraulic power unit → Page 148	
	Cover for weight, 9 kg → Page 143	
	Tabletop power supply unit → www.festo.com/didactic	
	Power supply unit for mounting frame → Page 158	



Recommended learning materials

Workbook



Campus license (→ Page 167)

de	8233632
en	8233633
es	8233635
fr	8233634

eLearning courses

→ Basic Principles of Electrohydraulics



→ Electrohydraulic Components



→ Basic Electrohydraulic Circuits

Recommended simulation software

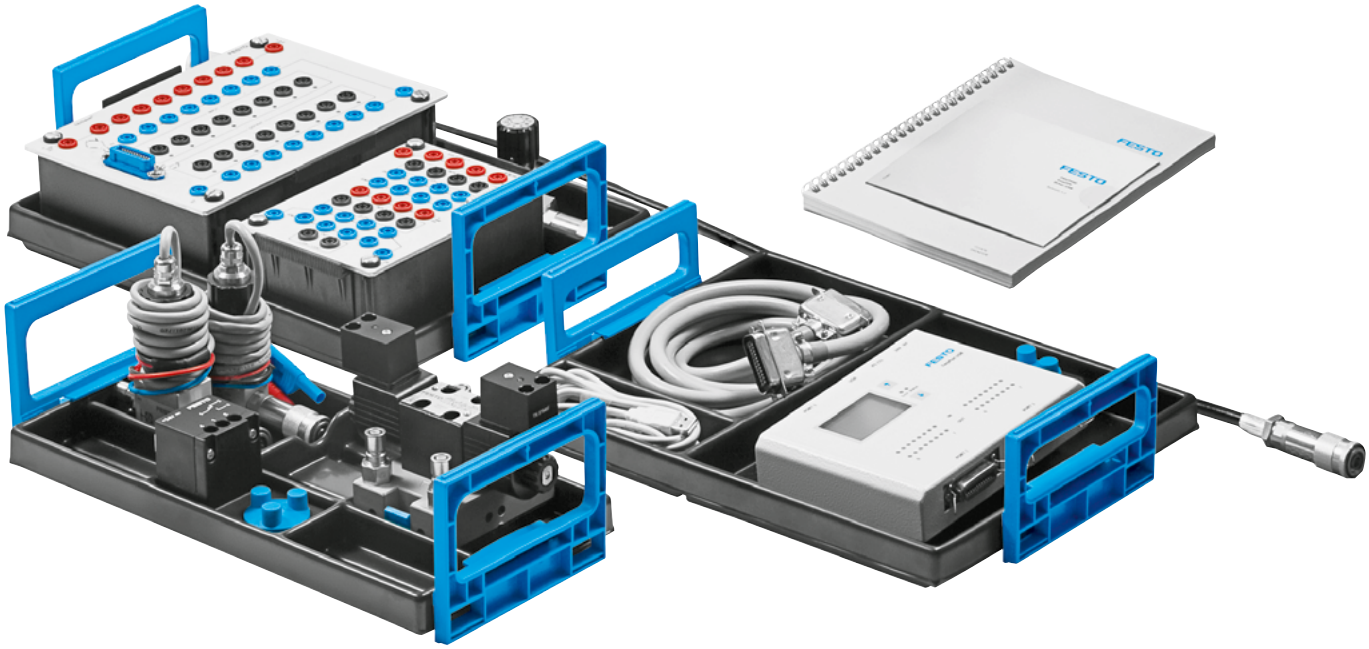
– FluidSIM Hydraulics
→ Page 168

Other learning materials

– Set of Posters on Hydraulics
→ page 171

Measurement and Control in Hydraulics with FluidLab-H

Equipment Set TP 610



Diagnostics, maintenance, and energy efficiency

The topics measurement and control in hydraulics are covered by the equipment set Measurement and Control in Hydraulics with FluidLab-H, TP 610. The content ranges from measuring individual hydraulic components to the basics of condition monitoring and closed-loop control technology. The importance of dealing responsibly with compressed air as a form of energy is also clearly highlighted in order to raise awareness.

The number and design of components in the equipment set and the project tasks stored in the FluidLab-H software are optimally coordinated. This software teaches the basics of measuring and analyzing the system and control behavior of hydraulic/electrohydraulic control systems.

Without needing tools and using just one hand, the components can be flexibly arranged on a profile plate with 50 mm slot spacing or in an ER mounting frame. All hydraulic and electrical connections are on the top of the components so they are easily accessible. The hydraulic connection is made without tools using low-leakage stainless steel couplings. The coupling nipple and coupling socket are self-sealing when uncoupled and are pressure-resistant up to 12 MPa. Sensors for pressure, temperature, and flow can be used at any coupling point.

The electrical components have 4 mm safety sockets or M8/M12 industrial connectors. All components are of industrial quality.

The components are supplied in practical equipment trays. The equipment trays not only fit in the drawers of the laboratory furniture, but also in a Systainer. Adhesive symbols for clearly labeling where components are stored in the equipment trays are included in the scope of delivery.

Components from the Basic Electrohydraulics TP 601 and Basic Hydraulics TP 501 equipment sets are required to carry out the project tasks.

Objectives
- Basics of measurement data acquisition and processing
- Selecting and adapting sensors
- Characteristic curves and characteristic values of electrohydraulic components
- Characteristics and applications of proportional-pressure regulators
- Control technology with continuous and discontinuous regulators

Advantages
- Fast PC-supported measured value recording
- Functional tests and optimization of pneumatic and hydraulic controllers
- FluidLab-H license included
- Supplied in an organized equipment tray for systainer and drawer

Complete Equipment Set TP 610 in organizer	**567194**

The most important components at a glance:

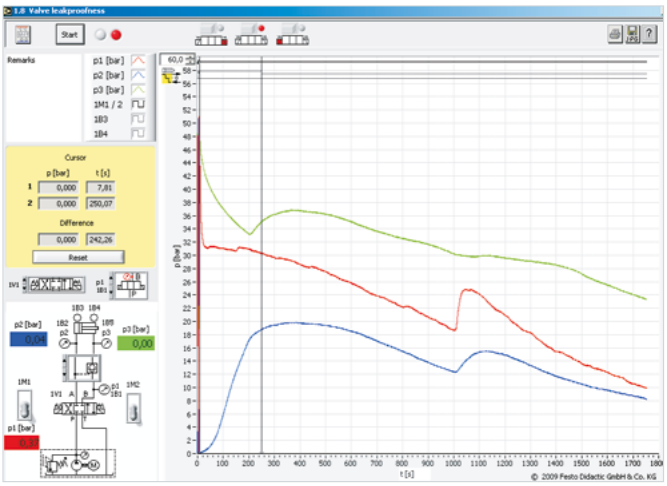
1x I/O data cable with SysLink plugs (IEEE 488), 2.5 m	34031
1x Universal connection unit, digital (SysLink)	162231
1x Analog cable, parallel, 2 m	529141
1x Terminal unit, analog	567232
1x EasyPort USB	548687
1x Quick-Fix screw adapter	549806
1x 4/3-way solenoid valve, relieving mid-position (AB –> T)	544348
2x Pressure sensor	525964
1x Flow control valve	152842
1x Resistance hose line with quick release couplings	549858
1x FluidLab-H single license, de/en	573286
1x Limit switch, electrical, left-actuated	183322

The following components are also required for the exercises on proportional and closed-loop hydraulics:

Proportional amplifier	162255
Displacement encoder for cylinder, 200 mm measuring stroke	167090
Mounting kit for cylinders	544371
4/3-way proportional valve	544350
Proportional pressure relief valve	544351
Pressure filter	548609

Optionally, the control valve can be used for the control technology instead of the proportional amplifier with the proportional valves.

4/3-way regulating valve	567269



FluidLab-H measuring software included

A key component of the training package TP 610 is the FluidLab-H software. In just a few simple steps, the interface is set up, the sensors adapted and the language (de/en) selected. Then the exercises begin. The exercises are divided into basic tests, cylinder controls, proportional technology, and closed-loop control technology. Connection diagrams, descriptions, and sample solutions support the implementation.
The software also controls the measurement process. Diagrams can be measured and printed using the cursors. In addition, the software includes the entire set of exercises with sample solutions as a PDF file.

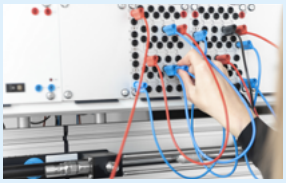
Recommended learning materials

eLearning courses

→ Basic Principles of Electrohydraulics



→ Electrohydraulic Components



→ Basic Electrohydraulic Circuits



eLab course

→ Basics of Electrohydraulics



Recommended simulation software

– FluidSIM Hydraulics
→ Page 168

Other learning materials

– Set of Posters on Hydraulics
→ page 171

Digitalization in Hydraulics
Equipment Set TP 660



Ready for digitalization and Industry 4.0!

The equipment set for Digitization in Hydraulics, TP 660, is a training package that offers an introduction to digitization in hydraulics, and demonstrates the potential of digitization in a hydraulic application. The components are selected in such a way that they can be used to produce records in a pressing machine, as well as upgrade measures in the field of digitalization to enable human-machine communication.

During the training, students take on the role of a maintenance technician who is tasked with increasing production output by gradually improving the machine with the help of digital functions. After each improvement, a production process is started and the efficiency of the machine is measured to ensure a higher OEE (Overall Equipment Effectiveness). This includes the implementation of PLC and proportional technology, as well as digital visualization and communication via mobile devices.

Equipment Set TP 660 is an advanced version of the equipment set for Electrohydraulics Basic Level, TP 601. Both equipment sets are required to complete all exercises of the Digitization in Hydraulics course.

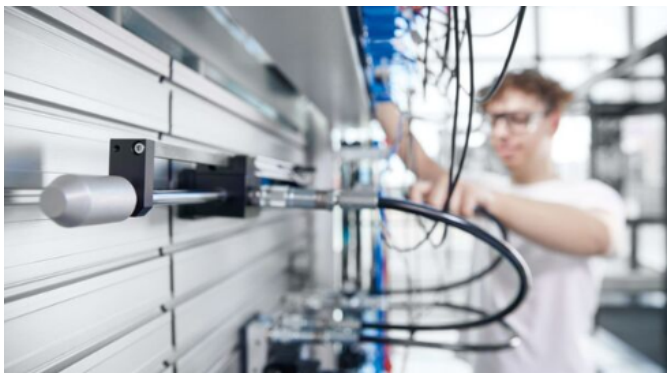
Objectives
- Knowing the important reference data for production
- Understanding the benefits of digitalization to improve production efficiency (OEE)
- Implementing digitalization on a conventional machine
- Selecting the appropriate sensors for the acquisition of digital data
- Analyzing digital data for condition monitoring
- Implementing a digital troubleshooting system for effective maintenance
- Implementing a network system for receiving digital data

Advantages
- Industrial quality components
- Role plays for the simulation of a real production environment
- Siemens S7-1200 with analog inputs and outputs
- Entry into digitalization, smart maintenance, and Industry 4.0
- Setting up a communication network

Complete Equipment Set TP 660 with PLC in organizer	**8173916**
Complete Equipment Set TP 660 without PLC in organizer	**8173871**

The most important components at a glance:

1x Proportional pressure relief valve	544351
1x Proportional amplifier	162255
1x EduTrainer Compact Preferred versions with SIMATIC S7-1200	8115009
2x Ethernet cable	567280
1x WLAN router, access point	8086515
1x Time relay, 2-way	162243
1x 4/2-way solenoid valve, spring-return	544346
1x 2-way flow control valve, defective	8065174
2x proximity switch, electronic	2342009
1x Mounting kit for cylinders	544371
1x Differential cylinder 16/10/200, defective	8065195
1x USB memory stick	8174271
1x Raspberry Pi 4, with SD card, power supply unit and housing with Quick-Fix adapter	8173920



For the North American market with US units and as per the NEMA standard:

Complete Equipment Set TP 660-NA with PLC in organizer	**8218027**
Complete Equipment Set TP 660-NA without PLC in organizer	**8218028**

Recommended learning materials

Campus license (→ Page 167)

de	8188067
en	8188100
es	8188102
fr	8188101

Learning courses

→ Basic Principles of Electrohydraulics



→ Electrohydraulic Components



→ Basic Electrohydraulic Circuits



eLab course

→ Digitalization in Hydraulics



Recommended simulation software

– FluidSIM Hydraulics
→ Page 168

Other learning materials

– Set of Posters on Hydraulics
→ page 171

Basic Proportional Hydraulics

Equipment Set TP 701



Introduction to proportional hydraulics

The equipment set for Proportional Hydraulics Basic Level, TP 701 provides information on proportional valves, their function and control using proportional amplifiers and setpoint value cards. This enables simple proportional controls to be set up, adjusted, and commissioned.

The number and design of the components of the equipment set and the projects of the training media are optimally coordinated. This makes for effortless teaching of the essential basics.

Without needing tools and using just one hand, the components can be flexibly arranged on a profile plate with 50 mm slot spacing or in an ER mounting frame to create a wide variety of pneumatic control systems. All hydraulic and electrical connections are on the top of the components so they are easily accessible. The hydraulic connection is made without tools using low-leakage stainless steel couplings. The coupling nipple and coupling socket are self-sealing when uncoupled and are pressure-resistant up to 12 MPa. Sensors for pressure, temperature, and flow can be used at any coupling point.

The electrical components have 4 mm safety sockets or M8/M12 industrial connectors. All components are of industrial quality.

The components are supplied in practical equipment trays. The equipment trays not only fit in the drawers of the laboratory furniture, but also in a Systainer. Adhesive symbols for clearly labeling where components are stored in the equipment trays are included in the scope of delivery.

Objectives
- The basics of proportional hydraulics
- Pressure and speed control
- Characteristics of proportional valves
- Characteristic curves of single-channel and dual-channel amplifiers
- Deducing ramps from function diagrams

Advantages
- Industrial quality components
- Electrical connections via 4 mm safety sockets
- Tool-free hydraulic connection with low-leakage couplings
- Supplied in an organized equipment tray for systainer and drawer

Complete Equipment Set TP 701	**184465**

The most important components at a glance:

1x	Relay, 3-way	162241
1x	Proportional amplifier	162255
1x	Setpoint value card	162256
1x	Signal input, electrical	162242
2x	Proximity switch, inductive, M12	548643
1x	4/3-way proportional valve	544350
1x	4/2-way solenoid valve, spring return	544346
1x	Proportional pressure relief valve	544351
1x	Pressure filter	548609
1x	Pressure compensator (proportional flow control valve)	159351
1x	Pressure relief valve	544335
1x	Differential cylinder 16/10/200 with cover	572746
1x	Hydraulic motor	152858
1x	Flow control valve	152842
1x	One-way flow control valve	152843
2x	Pressure gauge	152841
2x	T-distributor	152847
1x	Weight, 9 kg for cylinder	152972

Required accessories, order at the same time:

5x	Hose line with quick connection coupling, 600 mm	152960
2x	Hose line with quick connection couplings, 1500 mm	159386
	Measuring set	177468
	Pressure relief unit	152971
	4 mm safety laboratory cables → Page 159	
	Aluminum profile plate → Page 11, 17	
	Hydraulic power unit → Page 148	
	Cover for weight, 9 kg → Page 143	
	Tabletop power supply unit → www.festo.com/didactic	
	Power supply unit for mounting frame → Page 158	

Recommended learning materials

Workbook



Campus license (→ Page 167)

de	94457
en	94472
es	94404
fr	94352

eLearning courses

→ Open and Closed-Loop Control



→ Basic Principles of Hydraulics
→ Basic Principles of Electrohydraulics



Recommended simulation software

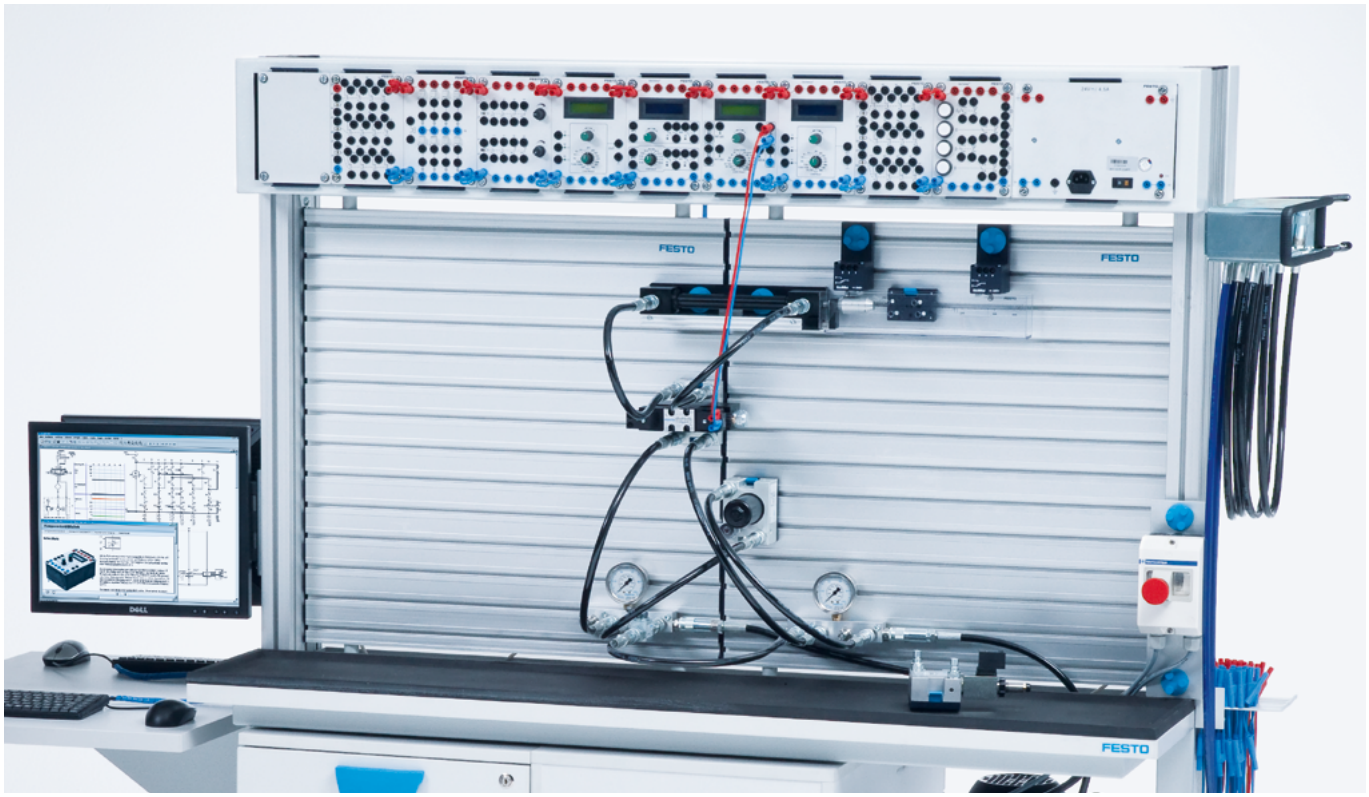
– FluidSIM Hydraulics
→ Page 168

Other learning materials

– Set of Posters on Hydraulics
→ page 171

Advanced Proportional Hydraulics

Equipment Set TP 702



Proportional hydraulics for advanced users

The equipment set for Proportional Hydraulics Advanced Level, TP 702, is based directly on the contents of the equipment set for Proportional Hydraulics Basic Level, TP 701. The use of additional hydraulic and electrical components enables extensive proportional control systems to be created.

The number and design of the components of the equipment set and the projects of the training media are optimally coordinated. This means that teaching the content of the comprehensive proportional hydraulic controllers at the advanced level is effortless.

Without needing tools and using just one hand, the components can be flexibly arranged on a profile plate with 50 mm slot spacing or in an ER mounting frame to create a wide variety of pneumatic control systems. All hydraulic and electrical connections are on the top of the components so they are easily accessible. The hydraulic connection is made without tools using low-leakage stainless steel couplings. The coupling nipple and coupling socket are self-sealing when uncoupled and are pressure-resistant up to 12 MPa. Sensors for pressure, temperature, and flow can be used at any coupling point.

The electrical components have 4 mm safety sockets or M8/M12 industrial connectors. All components are of industrial quality.

The components are supplied in practical equipment trays. The equipment trays not only fit in the drawers of the laboratory furniture, but also in a Systainer. Adhesive symbols for clearly labeling where components are stored in the equipment trays are included in the scope of delivery.

Components from the Basic Proportional Hydraulics Equipment Set TP 701 are required to carry out the project tasks.

Objectives
- Extensive proportional hydraulic controllers
- Characteristics of displacement, pressure, and temperature sensors
- Characteristics of proportional valves
- Characteristic curves of single-channel and dual-channel amplifiers
- Path-time and travel diagrams

Advantages
- Industrial quality components
- Tool-free hydraulic connection with low-leakage couplings
- Electrical connections via 4 mm safety sockets
- Supplied in an organized equipment tray for systainer and drawer

Complete Equipment Set TP 702	**184466**

The most important components at a glance:

1x	Setpoint value card	162256
1x	Comparator	8185562
1x	Time relay, 2-way	162243
1x	Indicator unit and distributor, electrical	162244
3x	Relay, 3-way	162241
1x	Limit switch, electrical, left-actuated	183322
1x	Limit switch, electrical, right-actuated	183345
1x	Proximity switch, capacitive, M12	548651
1x	Proximity switch, optical, M12	572744
1x	Non-return valve, piloted	544339
1x	T-distributor	152847
1x	Non-return valve, 0.05 MPa valve opening pressure	548617
1x	Displacement encoder for cylinders, 200 mm measuring stroke	167090
1x	Mounting kit for cylinders	544371

Required accessories, order at the same time:

5x	Hose line with quick connection coupling, 600 mm	152960
3x	Hose line with quick connection couplings, 1000 mm	152970
2x	Hose line with quick connection couplings, 1500 mm	159386
	Measuring set	177468
	Pressure relief unit	152971
	4 mm safety laboratory cables → Page 159	
	Aluminum profile plate → Page 11, 17	
	Hydraulic power unit → Page 148	
	Cover for weight, 9 kg → Page 143	
	Power supply unit for mounting frame → Page 158	

Recommended learning materials

Workbook



Campus license (→ Page 167)

de	94458
en	94473
es	94404
fr	8203925

eLearning courses

→ Open and Closed-Loop Control



→ Basic Principles of Hydraulics



→ Basic Principles of Electrohydraulics

Recommended simulation software

– FluidSIM Hydraulics
→ Page 168

Other learning materials

– Set of Posters on Hydraulics
→ page 171

Basics of Closed-Loop Hydraulics

Equipment Set TP 511



Understanding and setting up hydraulic control loops

Hydraulic closed-loop control circuits are normally operated with continuous valves. A control valve with integrated electronics, linear characteristic curve (volumetric flow rate relative to actuating piston position) and zero overlap makes commissioning easy, and provides good results in the closed-loop control circuit. The equipment set for Closed-Loop Hydraulics, TP 511 provides the necessary components.

The number and design of the components of the equipment set and the projects of the training media are optimally coordinated. This makes for effortless teaching of the essential basics.

Without needing tools and using just one hand, the components can be flexibly arranged on a profile plate with 50 mm slot spacing or in an ER mounting frame to create a wide variety of pneumatic control systems. All hydraulic and electrical connections are on the top of the components so they are easily accessible. The hydraulic connection is made without tools using low-leakage stainless steel couplings. The coupling nipple and coupling socket are self-sealing when uncoupled and are pressure-resistant up to 12 MPa. Sensors for pressure, temperature, and flow can be used at any coupling point.

The electrical components have 4 mm safety sockets or M8/M12 industrial connectors. All components are of industrial quality.

The components are supplied in practical equipment trays. The equipment trays not only fit in the drawers of the laboratory furniture, but also in a Systainer. Adhesive symbols for clearly labeling where components are stored in the equipment trays are included in the scope of delivery.

For the additional task 21 for position control with disturbance variables and active load, the brake cylinder for the linear drive (order no. 152295), which is not included in the scope of delivery, three additional hose lines with quick-release couplings and a shut-off valve (order no. 152844) are required.

Objectives
- Position control loops
- Pressure control circuits
- Selection criteria for regulators
- P, I, D, PI, PD and PID controllers
- Interference behavior and control factor

Advantages
- Industrial quality components
- Tool-free hydraulic connection with low-leakage couplings
- Electrical connections via 4 mm safety sockets
- Supplied in an organized equipment tray for systainer and drawer

Complete Equipment Set TP 511 in organizer	**8028723**

The most important components at a glance:

1x	PID controller	162254
1x	Status controller	162253
2x	Pressure sensor	525964
1x	Pressure gauge	152841
1x	Hydraulic motor	152858
1x	Flow sensor	567191
1x	Pressure filter	548609
1x	Flow control valve	152842
1x	Shut-off valve	152844
2x	4-way distributor with pressure gauge	159395
2x	T-distributor	152847
1x	4/3-way regulating valve	567269
1x	Linear drive	8028726
2x	Weight, 5 kg, for linear drive	34065

Required accessories, order at the same time:

4x	Hose line with quick connection coupling, 600 mm	152960
3x	Hose line with quick connection couplings, 1000 mm	152970
2x	Hose line with quick connection couplings, 1500 mm	159386
2x	Hose line with quick connection coupling, 3000 mm	158352
1x	Pressure relief unit	152971
1x	Function generator	8222730
3x	Cable BNC – 4 mm	8023959
1x	Cable BNC – BNC	158357
1x	T-connector BNC	159298
	4 mm safety laboratory cables → Page 159	
	Digital multimeter	8217596
	Aluminum profile plate → Page 11, 17	
	Digital storage oscilloscope → Page 157	
	Hydraulic power unit q > 3.5 l/min → Page 148	
	Power supply unit for mounting frame → Page 158	

Recommended learning materials

Workbook



Campus license (→ Page 167)

de	94460
en	94469
es	94368
fr	94469

eLearning courses

→ Open and Closed-Loop Control



→ Basic Principles of Hydraulics
→ Basic Principles of Electrohydraulics



Recommended simulation software

– FluidSIM Hydraulics
→ Page 168

Other learning materials

– Set of Posters on Hydraulics
→ page 171

Suitable for the Hydraulics course of the Federal Institute for Vocational Education and Training

Equipment Set for Hydraulics, Federal Institute for Vocational Training, Exercises A – Z

Equipment set for Hydraulics, Federal Institute for Vocational Training Hydraulics – Basic Equipment
Suitable for the Hydraulics course of the Federal Institute for Vocational Training, exercises A – Z

Training content
The basics of hydraulic control technology is conveyed by the 21 exercises of the Hydraulics course of the Federal Institute for Vocational Training. The topics covered are drive units, directional control valves and drives, shut-off and flow valves, pressure regulators and pressure switches, hydraulic accumulators, application circuits, lifting a load, burr circuit, neutral circulation of the pump flow, commissioning, and maintenance.

Basic equipment set in organizer	**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, unlockable	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

Required accessories, order at the same time:

6x Hose line with quick connection coupling, 600 mm	152960
4x Hose line with quick connection couplings, 1000 mm	152970
4x Hose line with quick connection coupling, 1500 mm	159386
Pressure relief unit	152971
4 mm safety laboratory cables → Page 159	
Digital multimeter	8217596
Aluminum profile plate → Page 11, 17	
Hydraulic power unit → Page 148	
Cover for weight, 9 kg → Page 143	
Tabletop power supply unit → www.festo.com/didactic	
Power supply unit for mounting frame → Page 158	

Combination options (can only be ordered in combination)
– Basic equipment set and supplementary equipment set for electrohydraulics (order no. 8025069 and order no. 8025073)
– Basic equipment set and supplementary equipment set for hand lever valves (order no. 8025069 and order no. 8025072)
– Basic equipment set and supplementary equipment set for hand lever valves and the Electrohydraulics Supplementary Equipment Set (Order nos. 8025069, 8025072 and 8025073)

Federal Institute for Vocational Training Equipment Set for Hydraulics – Electrohydraulics and Electrical Devices
Required for the Hydraulics training course of the Federal Institute for Vocational , exercises A - Z

In combination with the basic equipment set of the Federal Institute for Vocational Training (order no. 8025069), the institute's supplementary equipment set for Electrohydraulics provides all the equipment for carrying out the exercises A-Z of the institute's course on hydraulics.

Electrohydraulics extension set	**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 3-way	162241
1x Signal input, electrical	162242
1x Time relay, 2-way	162243
1x Proximity switch, inductive, M12	548643

Federal Institute for Vocational Training Hydraulics Equipment Set – Hand Lever Valves
Optional for the hydraulics course of the Federal Institute for Vocational Training, exercises without electrohydraulics

In combination with the basic equipment set of the Federal Institute for Vocational Training (order no. 8025069), the institute's equipment set for Hand Lever Valve provides the equipment required for carrying out the exercises without the electrohydraulic section of the institute's Hydraulics course.

Extension set for hand lever valves	**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, mid-position closed, 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 learning material

eLearning Course
– Basic Principles of Hydraulics
– Simple Hydraulic Circuits
– Hydraulic Actuators
– Hydraulic Valves
– Hydraulic Power Units
– Basic Principles of Electrohydraulics
– Electrohydraulic Components
– Basic Electrohydraulic Circuits

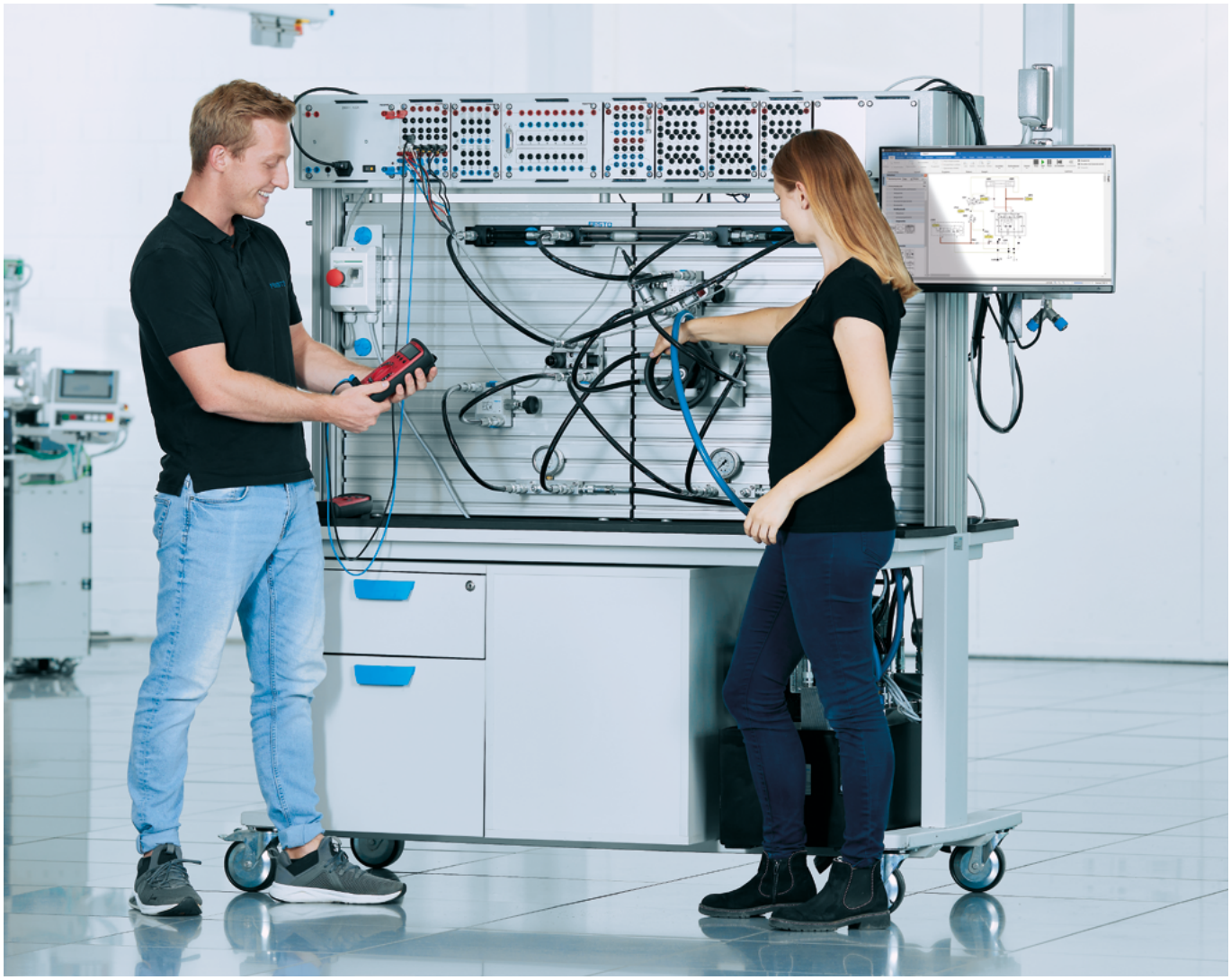
Recommended simulation software
– FluidSIM Hydraulics

Also order:

Federal Institute for Vocational Training Hydraulics course
(On request)

Mobile hydraulics

Equipment Set TP 800



Equipment Set TP 800 – Mobile Hydraulics

From the Basics to a Mobile Working Machine

Mobile hydraulics from Festo Didactic

Mobile hydraulics has many specific features compared to conventional industrial hydraulics. They are usually arranged directly on the 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 a better understanding.

Accessible
While there is usually little room in a vehicle and access is restricted to qualified personnel, the components of a learning system are manageable, easy to identify, and fault-tolerant.

Clean
Working on a vehicle usually means dealing with dirt and difficult atmospheric circumstances. A learning system is clean, clear, and ergonomic.

The equipment sets for mobile hydraulics from Festo Didactic closes the gap between the basics of hydraulics and the hydraulic systems on the vehicle.

A hydraulic power unit with variable displacement pump and load-sensing closed-loop controller, as well as a fixed displacement pump, provides the ideal start in mobile hydraulics. This means that the basic and advanced stages, as well as the load simulation can be carried out with just one unit.







Equipment sets:

Working Hydraulics – Basic Level
In the basic stage, flow controls with directional control valves with different mid-positions are compared in terms of their energy balance. A cylinder load simulator is used to simulate a wide variety of load situations, depending on the setup.

In addition, the topics of maintaining and reducing load, as well as two 6/3-way valves for controlling two actuators, are discussed using serial, parallel and tandem switching.

A simple load-sensing control system with a fixed displacement pump is implemented as a transition to the Advanced Working Hydraulics.

Working Hydraulics – Advanced Level
The focus here is on load-sensing systems with variable displacement pumps. This includes the design, operation and adjustment of a variable displacement pump with load-sensing closed-loop controller, and mobile or control block. Energy balances between throttle controls, open-center load sensing and closed-center load sensing with variable displacement pump can now be compared.

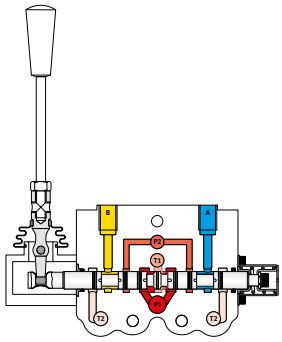
Remote control or hydraulic pilot control of mobile blocks can also be discussed and set up. In addition, the properties and limits of load-sensing systems with upstream and downstream pressure balances can be tested

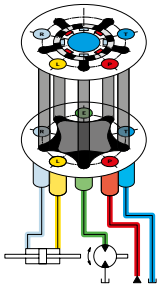
Hydrostatic Steering System
The working hydraulics can also be extended to include a steering system. The design and mode of operation of a hydrostatic steering system with typical shock and suction valves and steady-speed cylinders are explained.

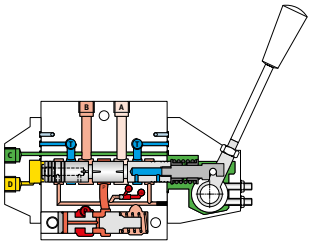
The influence and effect of loads on the steering cylinder are examined. Combinations of working hydraulics and steering systems can also be easily implemented, taking priority into account. The effect of the steering activity on the downstream working hydraulics also becomes clear

Workbook









21 project tasks are matched to Equipment Sets TP 801, TP 802 and TP 803 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 part
– Assignment sections comprising project assignments and sample solutions for TP 801, TP 802, and TP 803
– Didactic notes
– Working documents on data carrier/download
– Worksheets for the student

The basic part includes the following content:
– Definition of terms and hydraulic basics
– Closed hydraulic circuit
– Load-sensing systems and variable displacement pumps
– Current dividers
– Mobile control blocks
– 6/3-way proportional valves and valve configurations
– Pressure compensators
– Holding and lowering loads
– Hydraulic pilot control (joystick)
– Priority valves
– Steering systems

Exercise Section TP 801
Working Hydraulics 1
The learning section consisting of 9 project assignments is coordinated with the TP 801 equipment set.

With each project assignment, the achievable learning objectives are presented first. Afterwards, the vehicle or the application to be discussed is presented. The requirements ensure a uniform start and the project assignment ensures a structured procedure.

Energy usage rates of
– a flow control
– an open center load sensing controller
– a proportional valve (supply)
– a proportional valve (inlet and outlet) without and with open center load sensing controller
– a proportional valve with pump circulation without and with loaded cylinder

Holding and lowering loads
– Holding loads (piloted non-return valves)
– Lowering loads (counterbalancing)
– Lowering loads (counterbalancing valve)

Circuits with several consumers
– Properties of the parallel connection
– Properties of the tandem connection
– Properties of the series connection

Exercise Section TP 802
Hydrostatic Steering System
The learning section consisting of 5 project assignments is coordinated with the TP 802 equipment set.

In all project assignments, a circuit is built with a given circuit diagram while taking into account the instructions, and the measurements and calculations are also carried out. Comprehension questions are asked at the end of a project assignment. The readings, calculations and answers can then be compared with the sample solutions and discussed.

Basics of hydrostatic steering
– Design of a steering system with steady-speed cylinder
– Design of a steering system with two differential cylinders
– Displacement volume of the steering valve
– Emergency steering characteristics of the steering valve
– Load and overload in the steering system
– Torque dependence of the steering valve
– Priority of the steering system and secondary consumers

Exercise Section TP 803
Working Hydraulics 2
The learning section consisting of 7 project assignments is coordinated with the TP 803 equipment set.

The content builds on the learning content of TP 801 Working Hydraulics 1 and expands it to include the complex topic of systems with load-sensing controlled variable displacement pump. At the same time, the level of complexity always remains manageable due to the successive project tasks.

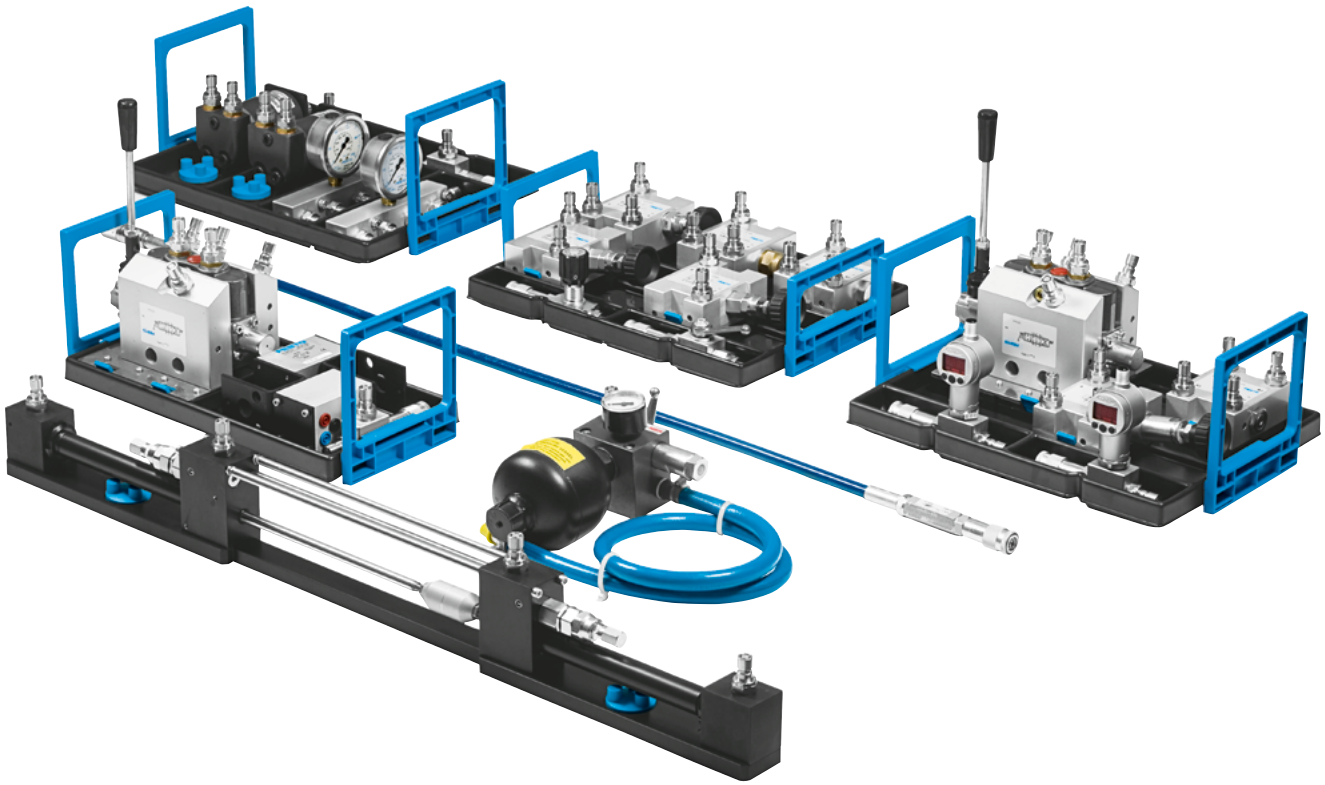
Load-sensing systems
– Structure and function of a control block
– Control block with closed center load sensing
– Control block with two consumers
– Volume flow limitation on the control block
– Pilot control of a control block
– Load and flow rate dependencies
– Function of an upstream pressure compensator
– Pressure compensation with load sensing
– Properties of upstream pressure compensators with more than one consumer
– Properties of downstream pressure compensators with more than one consumer

Campus license (→ Page 167)

de	**574165**
en	**574166**
es	**8042424**

Basic Mobile Hydraulics – Working Hydraulics 1

Equipment Set TP 801



Discover and understand mobile hydraulics

The fundamentals of mobile hydraulics are taught with the Basic Mobile Hydraulics – Working Hydraulics 1 Equipment Set TP 801.
The energy balances in different hydraulic systems – also under load – are examined and evaluated. The behavior of consumers under load and options for safely holding and lowering a load are taught, optimally coordinated with the training media, which provide clear project tasks.

The number and design of the components of the equipment set and the projects of the training media are optimally coordinated. This makes for effortless teaching of the essential basics.

Without needing tools and using just one hand, the components can be flexibly arranged on a profile plate with 50 mm slot spacing.

All hydraulic and electrical connections are on the top of the components so they are easily accessible.

The hydraulic connection is made without tools using low-leakage stainless steel couplings. The coupling nipple and coupling socket are self-sealing when uncoupled and are pressure-resistant up to 12 MPa. Sensors for pressure, temperature, and flow can be used at any coupling point.

The electrical components have 4 mm safety sockets or M8/M12 industrial connectors. All components are of industrial quality.

The components are supplied in practical equipment trays. The equipment trays not only fit in the drawers of the laboratory furniture, but also in a Systainer. Adhesive symbols for clearly labeling where components are stored in the equipment trays are included in the scope of delivery.

Objectives
- Differences between stationary hydraulics and mobile hydraulics
- Energy consumption and energy losses in hydraulic systems
- Function and advantages of a constant displacement pump with open-center load-sensing pressure compensator
- Design and function of 6/3-way proportional valve
- Behavior of cylinders under load

Advantages
- Industrial quality components
- Double pump unit with pressure-limited constant displacement pump and load-sensing controlled variable displacement pump
- Tool-free hydraulic connection with low-leakage couplings
- Supplied in an organized equipment tray for systainer and drawer

Basic Hydraulics Supplementary Equipment set to Basic Mobile Hydraulics – Working Hydraulics 1, TP 501 – TP 801

You will use the Basic Hydraulics Equipment Set TP 501 in your training. With the supplementary equipment set, you can extend the range of functions to the complete Basic Mobile Hydraulics – Working Hydraulics 1 Equipment Set TP 801.

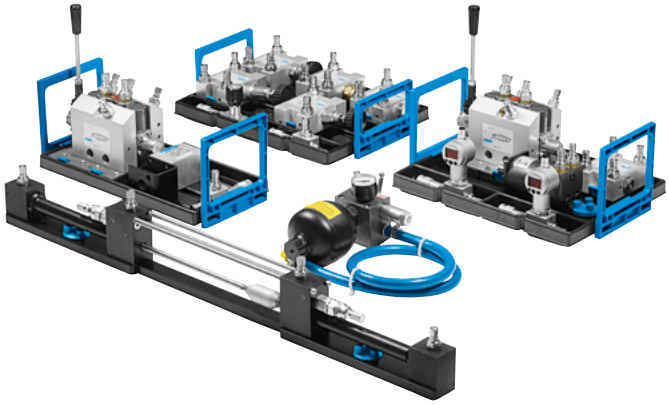
For the **learning objectives and advantages**, see the Basic Mobile Hydraulics – Working Hydraulics 1 Equipment Set TP 801.

Complete Equipment Set TP 801 in organizer	**574161**
The most important components at a glance:	
1x Counterbalancing valve	572149
1x Pressure compensator for open center load sensing	572123
1x 3-way pressure reducing valve	544337
2x Pressure relief valve	544335
1x Flow control valve	152842
1x Non-return valve, 0.6 MPa valve opening pressure	548618
1x Shuttle valve	572122
1x Double non-return valve, piloted	572151
1x Shut-off valve	152844
2x 6/3-way proportional hand lever valve	572141
1x Loading unit/cylinder load simulator	572145
1x Diaphragm accumulator with shut-off block	152859
2x Hydraulic motor	152858
2x 4-way distributor with pressure gauge	159395
3x T-distributor	152847
2x Pressure switch, electronic	548612
2x Flow sensor	567191

Required accessories, order at the same time:

10x Hose assembly with quick connection couplings, 600 mm	152960
4x Hose line with quick connection couplings, 1000 mm	152970
2x Hose line with quick connection couplings, 1500 mm	159386
2x Digital multimeter	8217596
4 mm safety laboratory cables → Page 159	
Hydraulic power unit → Page 148	
Power supply unit for mounting frame → Page 158	

Complete Supplementary Equipment Set TP 501 – TP 801 in organizer	**574160**
The most important components at a glance:	
1x Counterbalancing valve	572149
1x Pressure compensator for open center 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, piloted	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



Recommended learning materials

Workbook



Campus license (→ Page 167)

de	574165
en	574166
es	8042424

eLearning courses

→ Basic Principles of Hydraulics
→ Simple Hydraulic Circuits
→ Hydraulic Actuators



→ Hydraulic Valves
→ Hydraulic Power Units
→ Basic Principles of Electrohydraulics



→ Electrohydraulic Components
→ Basic Electrohydraulic Circuits

Recommended simulation software

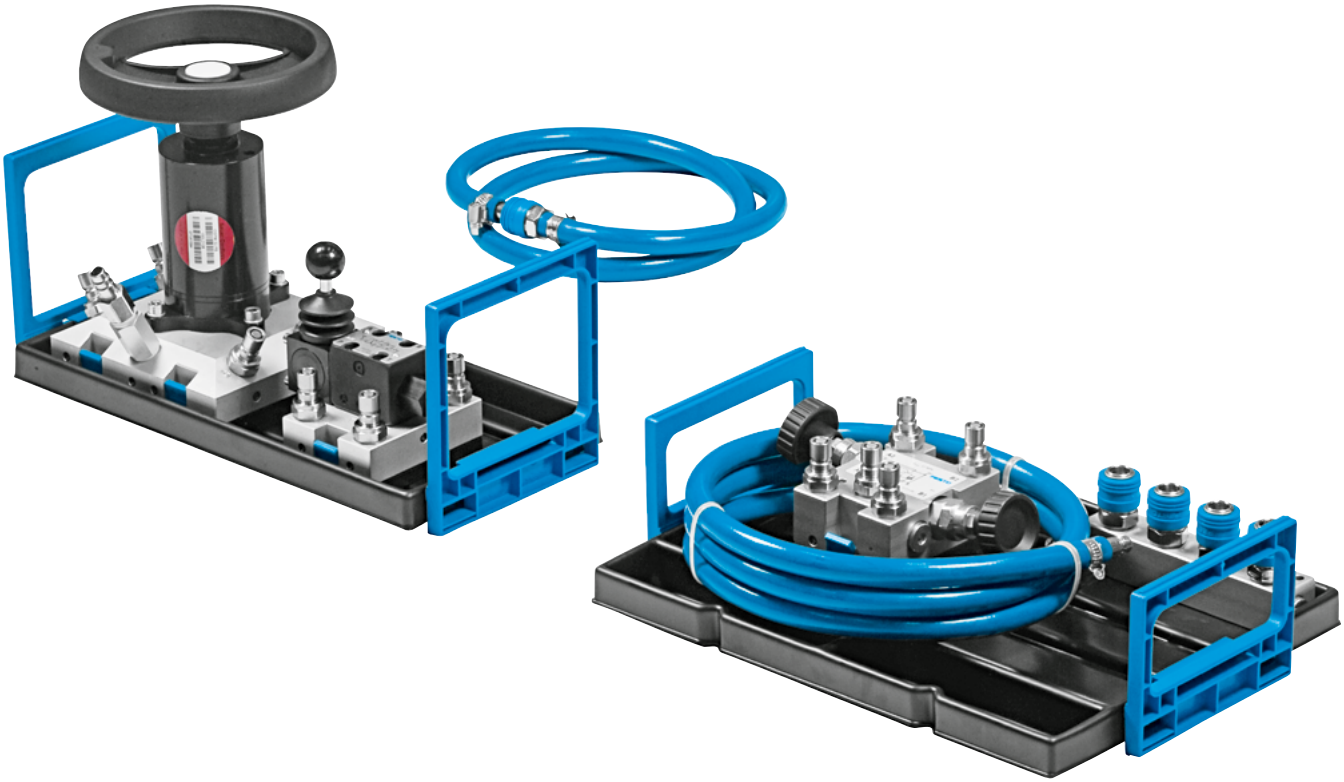
– FluidSIM Hydraulics → Page 168
– TP 810 Diagnostic System with Fluidlab-M → Page 112

Other learning materials

– Set of Posters on Hydraulics → page 171

Advanced Mobile Hydraulics – Hydrostatic Steering System

Equipment Set TP 802



Mobile machines hydrostatic steering

Hydrostatic steering systems on suitable hydraulic controllers are set up and tested with the Mobile Hydraulics – Hydrostatic Steering System Equipment Set TP 802. The controllers contain typical steering system components such as a steering valve, shock and suction valve, steering cylinder and, if required, a secondary consumer.

The number and design of the components of the equipment set and the projects of the training media are optimally coordinated. As a result, the content of the hydrostatic steering systems at the advanced level can be taught with little effort.

Without needing tools and using just one hand, the components can be flexibly arranged on a profile plate with 50 mm slot spacing. All hydraulic and electrical connections are on the top of the components so they are easily accessible. The hydraulic connection is made without tools using low-leakage stainless steel couplings. The coupling nipple and coupling socket are self-sealing when uncoupled and are pressure-resistant up to 12 MPa. Sensors for pressure, temperature, and flow can be used at any coupling point.

The electrical components have 4 mm safety sockets or M8/M12 industrial connectors. All components are of industrial quality.

The components are supplied in practical equipment trays. The equipment trays not only fit in the drawers of the laboratory furniture, but also in a Systainer. Adhesive symbols for clearly labeling where components are stored in the equipment trays are included in the scope of delivery.

Components from Basic Mobile Hydraulics – Working Hydraulics 1 Equipment Set TP 801 are required to carry out the project tasks.

Objectives
- Function and application of shock valves
- Steering valves and non-reaction steering valves
- Behavior of the steering system under the influence of external forces
- Priority function

Advantages
- Industrial quality components
- Tool-free hydraulic connection with low-leakage couplings
- Double pump unit with pressure-limited constant displacement pump and load-sensing controlled variable displacement pump
- Supplied in an organized equipment tray for systainer and drawer

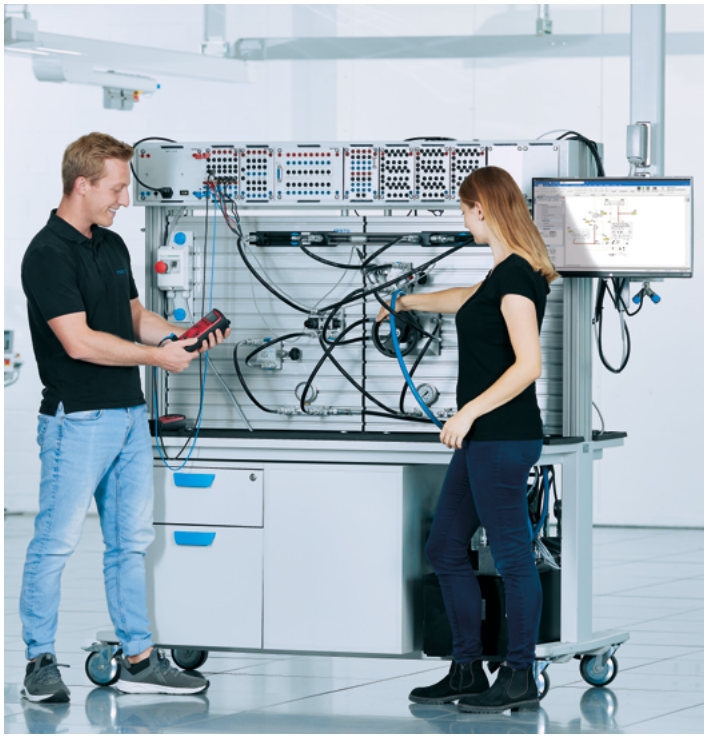
Complete Equipment Set TP 802 in organizer	**574162**

The most important components at a glance:

1x	Steering unit (Orbitrol)	572146
1x	Shock and anti-cavitation valve	572148
1x	4/3-way hand lever valve, relieving mid-position (AB–>T), detenting	544344
1x	Tubing line for unpressurized return	573024
1x	4-way return header, unpressurized	573026

Required accessories, order at the same time:

9x	Hose assembly with quick connection coupling, 600 mm	152960
4x	Hose line with quick connection couplings, 1000 mm	152970
3x	Hose assembly with quick connection coupling, 1500 mm	159386
2x	Digital multimeter	8217596
	4 mm safety laboratory cables → Page 159	
	Hydraulic power unit → Page 148	
	Power supply unit for mounting frame → Page 158	



Recommended learning materials

Workbook



Campus license (→ Page 167)

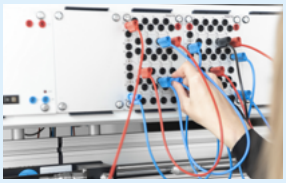
de	574165
en	574166
es	8042424

eLearning courses

- → Basic Principles of Hydraulics
- → Simple Hydraulic Circuits
- → Hydraulic Actuators
- → Hydraulic Valves
- → Hydraulic Power Units



- → Basic Principles of Electrohydraulics
- → Electrohydraulic Components



- → Basic Electrohydraulic Circuits

Recommended simulation software

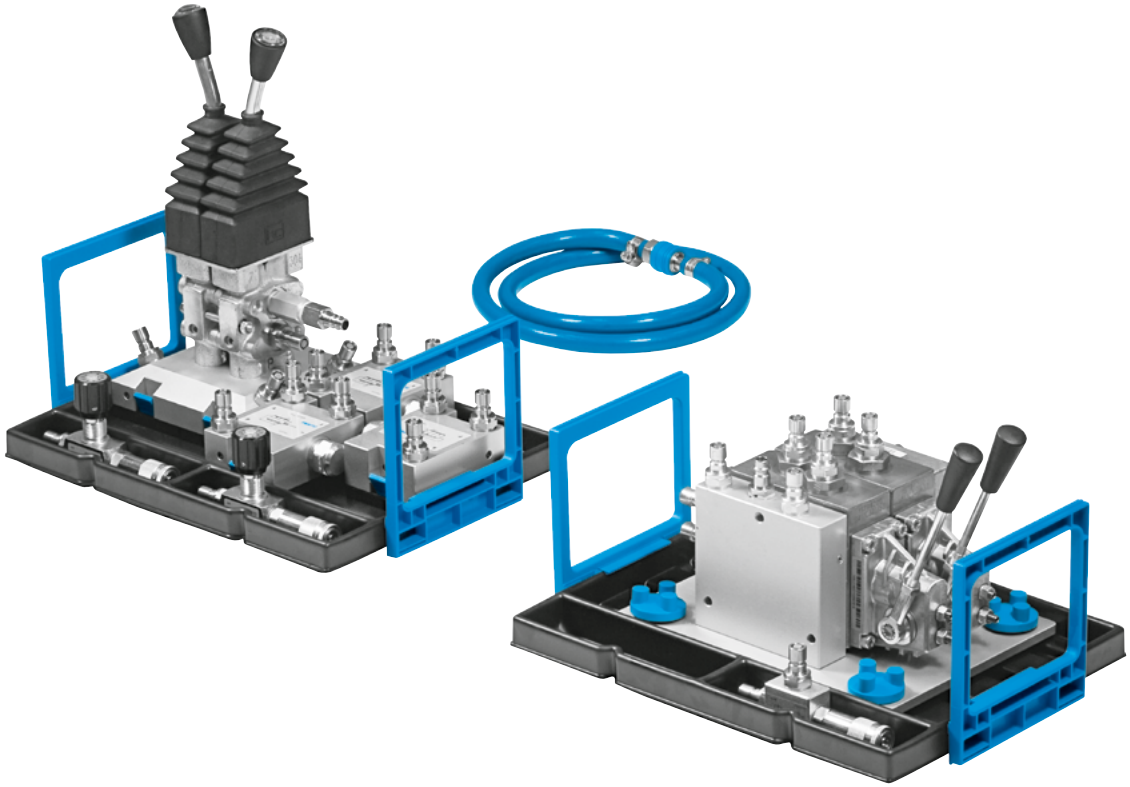
– FluidSIM Hydraulics → Page 168
– TP 810 Diagnostic System with Fluidlab-M → Page 112

Other learning materials

– Set of Posters on Hydraulics → page 171

Advanced Mobile Hydraulics – Working Hydraulics 2

Equipment Set TP 803



Efficient operation with load-sensing systems

In-depth knowledge of working hydraulics and hydraulic controls with load-sensing controlled variable displacement pump are built up and examined with Advanced Mobile Hydraulics – Working Hydraulics 2 Equipment Set TP 803.

The number and design of the components of the equipment set and the projects of the training media are optimally coordinated. As a result, the contents of Advanced Working Hydraulics 2 can be taught with little effort.

The components can be arranged variably
on a profile plate with 50 mm slot spacing without tools and with one hand. All hydraulic and electrical connections are on the top of the components so they are easily accessible. The hydraulic connection is made without tools using low-leakage stainless steel couplings. The coupling nipple and coupling socket are self-sealing when uncoupled and are pressure-resistant up to 12 MPa. Sensors for pressure, temperature, and flow can be used at any coupling point.

The electrical components have 4 mm safety sockets or M8/M12 industrial connectors. All components are of industrial quality.

The components are supplied in practical equipment trays. The equipment trays not only fit in the drawers of the laboratory furniture, but also in a Systainer. Adhesive symbols for clearly labeling where components are stored in the equipment trays are included in the scope of delivery.

Components from the Basic Mobile Hydraulics – Working Hydraulics 1 TP 801 and Advanced Mobile Hydraulics – Hydrostatic Steering System TP 802 equipment sets are required to carry out the project tasks.

Objectives
- Load-sensing systems
- Variable displacement pumps
- Upstream and downstream pressure compensators, hydraulic joystick
- Constant speed despite load changes

Advantages
- Industrial quality components
- Tool-free hydraulic connection with low-leakage couplings
- Double pump unit with pressure-limited constant displacement pump and load-sensing controlled variable displacement pump
- Supplied in an organized equipment tray for systainer and drawer

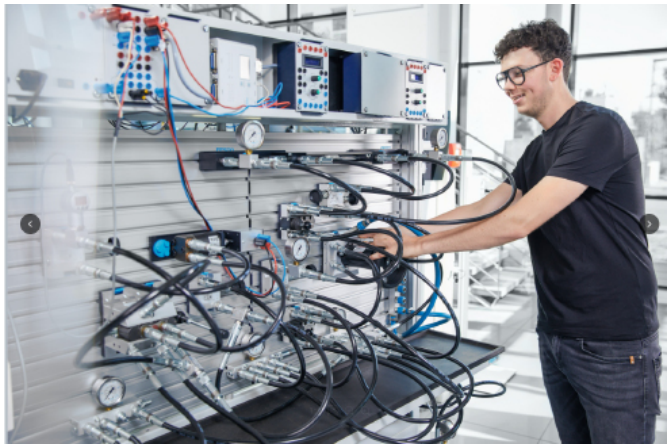
Complete Equipment Set TP 803 in organizer	**574163**

The most important components at a glance:

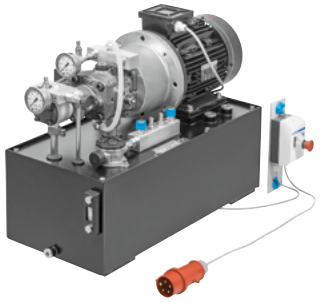
1x	Pilot control device (joystick), 2x2-channel	572147
1x	Load sensing control block	572144
1x	Pressure compensator, upstream	573023
2x	Pressure compensator, downstream	572741
2x	Flow control valve	152842
1x	T-distributor	152847
1x	Tubing line for unpressurized return	573024

Required accessories, order at the same time:

10x	Hose assembly with quick connection couplings, 600 mm	152960
6x	Hose assembly with quick connection coupling, 1000 mm	152970
3x	Hose assembly with quick connection coupling, 1500 mm	159386
2x	Digital multimeter	8217596
	4 mm safety laboratory cables → Page 159	
	Hydraulic power unit → Page 148	
	Power supply unit for mounting frame → Page 158	



The hydraulic power unit
A variable and fixed displacement pump combination is used as the power unit for the mobile hydraulics training packages. The fixed displacement pump is ideal for both basic hydraulics and electrohydraulics, as well as for the TP 801 and TP 802 mobile hydraulics. From the TP 803 onwards, the variable displacement pump with load-sensing closed-loop controller takes center stage, with the fixed displacement pump now being used to apply active hydraulic loads to the cylinder load simulator



Recommended learning materials

Workbook



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de	574165
en	574166
es	8042424

eLearning courses

→ Load-Sensing Systems, Mobile Hydraulicsk



→ Basic Principles of Hydraulics
→ Simple Hydraulic Circuits
→ Hydraulic Actuators
→ Hydraulic Valves
→ Hydraulic Power Units
→ Basic Principles of Electrohydraulics



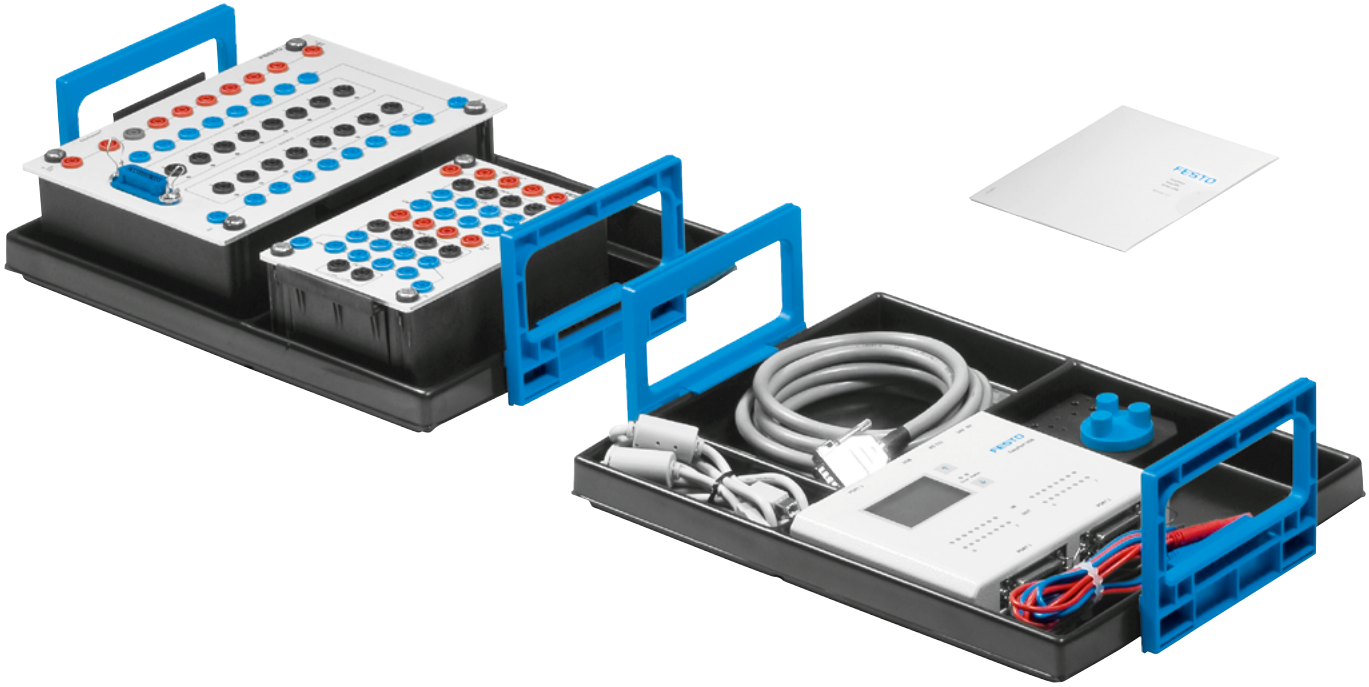
→ Electrohydraulic Components
→ Basic Electrohydraulic Circuits

Recommended simulation software

– FluidSIM Hydraulics → Page 168
– TP 810 Diagnostic System with Fluidlab-M → Page 112

Diagnostic System FluidLab-M – Advanced Level Measuring, Visualizing, and Analyzing

Equipment Set TP 810



Measuring, visualizing, and analyzing

A fluid technology system can only be optimally adjusted if measurements are taken at the right points. Conclusions about the system can be drawn from the measurement data. Under dynamic system conditions, measured value acquisition, e.g., using pressure gauges, reaches its limits. A permanent recording of measured values with associated visualization of the measurement curves is necessary. This recording provides the operating and maintenance personnel with crucial information for the exercises at hand and the necessary settings. FluidLab-M is the universal measuring tool for all pneumatic and hydraulic systems.

For extended fluid technology training, the Diagnostic System FluidLab-M – Advanced Level Equipment Set TP 810 contains all components, based on any sensor system with analog voltage output and 4 mm safety plugs.

Without needing tools and using just one hand, the components can be flexibly arranged on a profile plate with 50 mm slot spacing or in an ER mounting frame. All electrical connections are located on the conveniently accessible top of the components. The electrical components have 4 mm safety sockets. All components are of industrial quality.

The components are supplied in practical equipment trays. The equipment trays not only fit in the drawers of the laboratory furniture, but also in a Systainer. Adhesive symbols for clearly labeling where components are stored in the equipment trays are included in the scope of delivery.

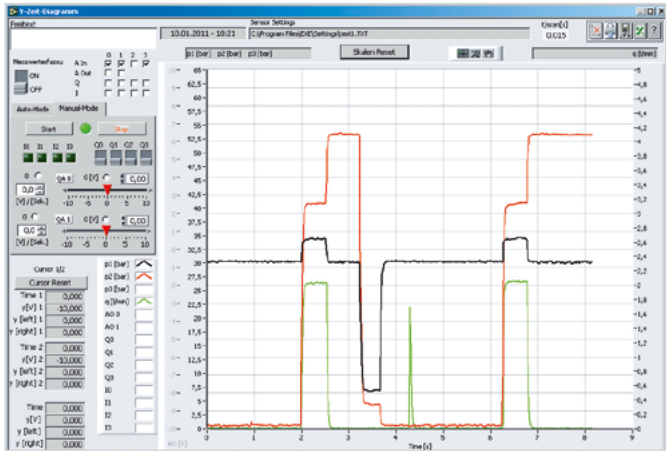
Objectives
- Basics of measurement data acquisition and processing
- Visualization of measured values
- Parameterization of sensors with analog output signal
- Programming of measuring sequences
- Further processing of the measurement data with spreadsheet programs

Advantages
- Fast PC-supported measured value recording
- Functional tests and optimization of pneumatic and hydraulic controllers
- FluidLab-M license included
- Supplied in an organized equipment tray for systainer and drawer

Complete Equipment Set TP 810 in organizer	**574164**

The most important components at a glance:

1x EasyPort USB	548687
1x Analog cable, parallel, 2 m	529141
1x I/O data cable with SysLink plugs (IEEE 488), 2.5 m	34031
1x Universal connection unit, digital (SysLink)	162231
1x Quick-Fix screw adapter	549806
1x Terminal unit, analog	567232
1x FluidLab-M single license, de/en	573029



FluidLab-M

Recommended learning materials

Workbook



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eLearning courses

→ Basic Principles of Hydraulics



→ Simple Hydraulic Circuits
→ Hydraulic Actuators
→ Hydraulic Valves
→ Hydraulic Power Units
→ Basic Principles of Electrohydraulics
→ Electrohydraulic Components
→ Basic Electrohydraulic Circuits



Recommended simulation software

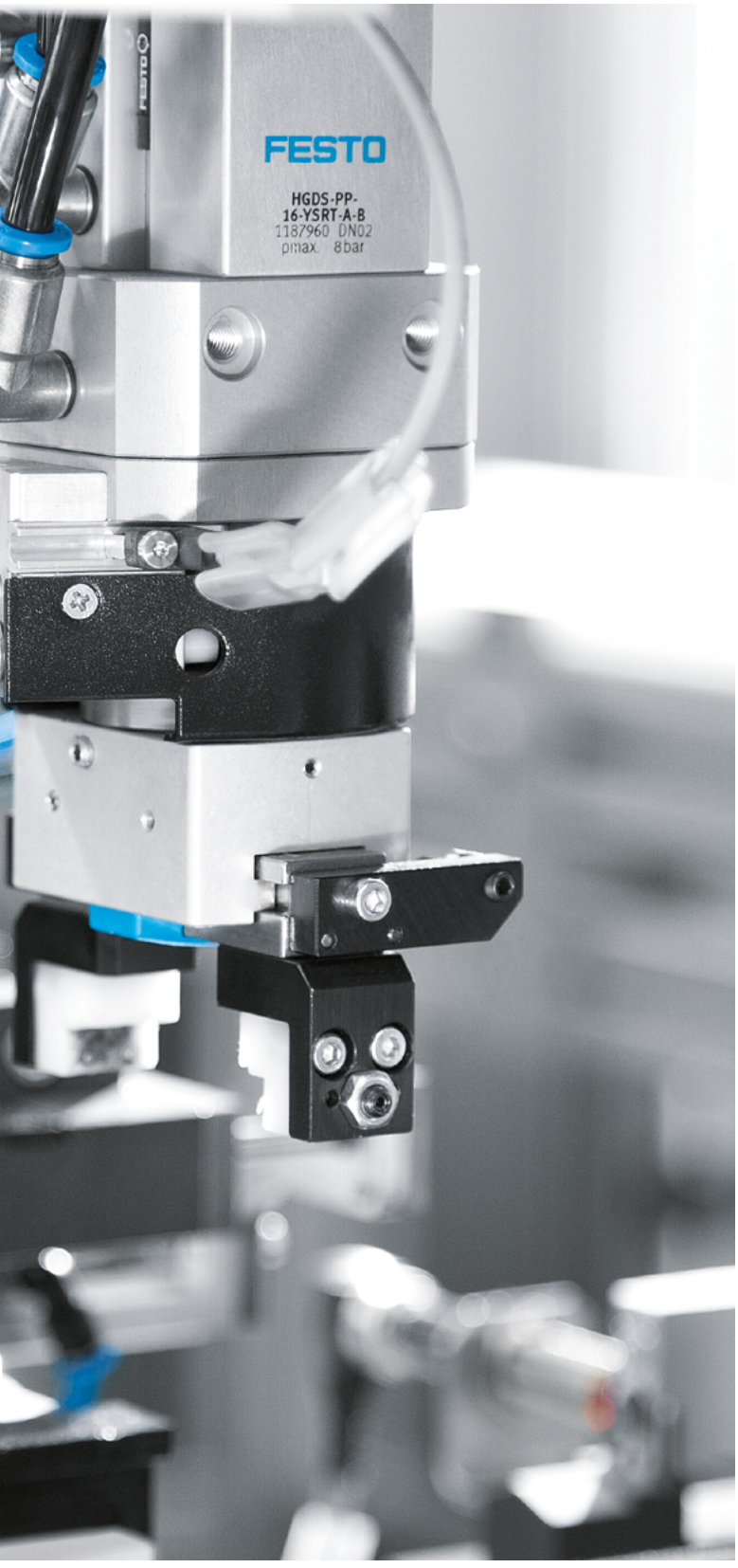
– FluidSIM Hydraulics
→ Page 168

Other learning materials

– Set of Posters on Hydraulics
→ page 171

Components





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Pneumatics
Directional Control Valves

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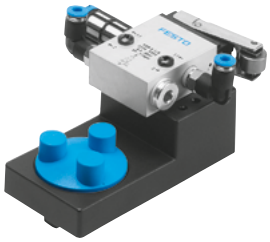

1/2/3/4/5 **Directional control valves, manually operated**
Poppet valve, directly actuated on one side, with spring return, push-in fittings for plastic tubing with O.D. 4 mm.
– Actuating force at 600 kPa (6 bar): 6 N
– Standard nominal flow rate: 1(P) – 2(A) 60 l/min
– Quick-action mounting system Quick-Fix

1 **3/2-way valve with pushbutton actuator, normally closed**
– Actuation: Pushbutton
– Pressure range: –95 – 800 kPa (–0.95 – 8 bar)

Order no.	**152860**

2 **3/2-way valve with pushbutton actuator, normally open**
– Actuation: Pushbutton
– Pressure range: –95 – 800 kPa (–0.95 – 8 bar)

Order no.	**152861**

3 **5/2-way panel mounted valve with selector switch**
– Actuation: Selector switch
– Pressure range: 0 – 800 kPa (0 – 8 bar)

Order no.	**152862**

4 **3/2-way valve with selector switch, normally closed**
– Actuation: Selector switch
– Pressure range: 0 – 800 kPa (0 – 8 bar)

Order no.	**152863**

5 **3/2-way valve with mushroom actuator (red), normally open**
Poppet valve, directly actuated in one direction, with spring return. The valve is actuated when the red mushroom actuator is pressed. Once the actuator is released, the switching status is retained. Turning the mushroom actuator clockwise will return it to its basic setting again, with the valve set to its normal position by the return spring.
– Actuation: Mushroom actuator
– Pressure range: 0 – 800 kPa (0 – 8 bar)

Order no.	**152864**

6/7/8 **Directional control valve, mechanically operated**
Poppet valve, indirectly actuated in one direction, with spring return.
– Actuating force at 600 kPa (6 bar): 1.8 N
– Quick-action mounting system Quick-Fix

6 **3/2-way roller lever valve with idle return, normally closed**
The roller lever valve with idle return is actuated when the trip cam of a cylinder traverses the sensing roller from a certain direction. After the sensor roller is released, the valve is returned to its initial position by a return spring. When passing in the opposite direction, the sensor roller folds over and the valve is not actuated.
– Pressure range: 0 – 800 kPa (0 – 8 bar)
– Standard nominal flow rate 1 – 2: 80 l/min

Order no.	**152867**

7/8 **3/2-way roller lever valve, normally closed**
The roller lever valve is actuated by pressing the roller lever with the trip cam of a cylinder, for example. After the roller lever is released, the valve is returned to its initial position by a return spring.
– Pressure range: 350 – 800 kPa (3.5 – 8 bar)
– Standard nominal flow rate 1 – 2: 120 l/min

Order no.	**152866**

8 **3/2-way roller lever valve, normally open**

Order no.	**162267**

Pneumatics
Directional Control Valves

1/2/3/4/5/6 **Directional control valves, pneumatically actuated**
Directly operated, monostable and bistable spool valves with mechanical spring return.
– Push-in fitting for plastic tubing with O.D. 4 mm.
– Symbol, port identification and connection position to DIN ISO 1219.
– Pilot pressure: 150 – 1000 kPa (1.5 – 10 bar)
– Operating pressure: –90 – 1000 kPa (–0.9 – 10 bar)
– Suitable for vacuum and reverse operation
– Quick-action mounting system Quick-Fix

1 **3/2-way valve, pneumatically actuated on one side**
Order no. **576302**

2 **5/2-way valve, pneumatically actuated on one side**
Order no. **576307**

3 **5/2-way double pilot valve, pneumatically actuated on both sides**
Order no. **576303**

4 **5/3-way valve, mid-position pressurized**
Order no. **576305**

5 **5/3-way valve, mid-position exhausted**
Order no. **576306**

6 **5/3-way valve, mid-position closed**
Order no. **576304**

7/8/9/10/11 **Directional control valves, electromagnetically actuated**
Piloted, monostable, and bistable spool valves with pneumatic spring return, non-detenting and detenting manual override and LED.
– Electrical connection via integrated 4 mm safety sockets
– Operating voltage 24 V DC
– Pneumatic connection, via push-in fitting for plastic tubing with O.D. 4 mm.
– Quick-action mounting system Quick-Fix

7 **2 x 3/2-way solenoid valve with LED, normally closed**
– Switching time on/off: 6/16 ms
– Operating pressure: 150 – 800 kPa (1.5 – 8 bar)
Order no. **567198**

8 **2 x 3/2-way solenoid valve with LED, normally open**
– Switching time on/off: 6/16 ms
– Operating pressure: 150 – 800 kPa (1.5 – 8 bar)
Order no. **8201546**

9 **5/2-way solenoid valve with LED**
– Switching time on/off: 7/19 ms
– Operating pressure: 250 – 800 kPa (2.5 – 8 bar)
Order no. **567199**

10 **5/2-way double solenoid valve with LED**
– Switching time: 7 ms
– Operating pressure: 150 – 800 kPa (1.5 – 8 bar)
Order no. **567200**

11 **5/3-way solenoid valve, mid position closed**
– Switching time: 7 ms
– Operating pressure: 150 – 800 kPa (1.5 – 8 bar)
Order no. **567201**

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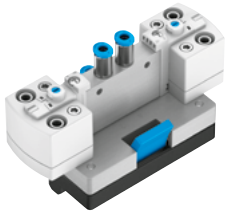

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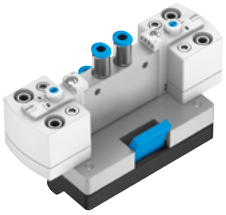

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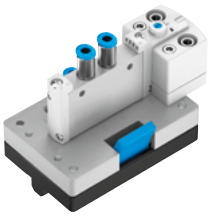

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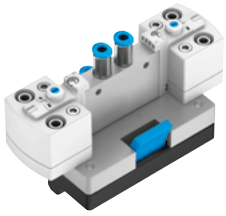

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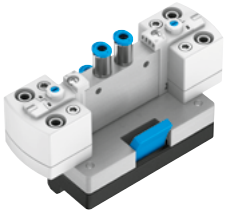

Pneumatics

Directional Control Valves and Pressure Regulators

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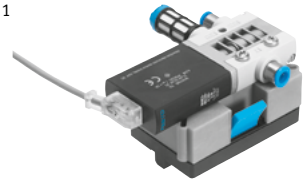

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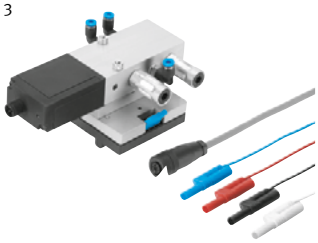

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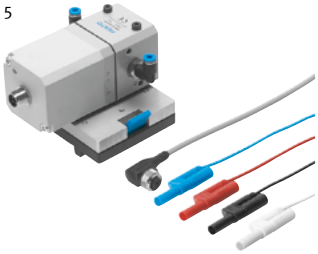

1 **3/2-way fast-switching solenoid valve, normally closed**
Normally closed single-solenoid poppet valve with mechanical spring and non-detenting manual override.
– Electrical connection with 4 mm safety plug
– Operating voltage 24 V DC
– Pneumatic connection, via push-in fitting for plastic tubing with O.D. 6 mm.
– Switching time on/off: 2.3/2.8 ms
– Max. switching frequency: 280 Hz
– Operating pressure: –90 – 800 kPa (–0.9 – 8 bar)
– Quick-action mounting system Quick-Fix

Order no. **544312**

2 **Valve terminal VTUX with 4 valve slices (MMJJ)**
Valve terminal VTUX with two 5/2-way solenoid valves and two 5/2-way double solenoid valves. The solenoid coils are connected to power with safety plugs that are labeled with the coil index.
– Switching status indicator: LED
– Operating pressure: –70 – 700 kPa (–0.7 – 7 bar)
– Pilot pressure: 150 – 700 kPa (1,5 – 7 bar)
– Standard nominal flow rate: 470 – 690 l/min
– Operating voltage: 24 V DC
– Quick-action mounting system Quick-Fix

Order no. **8231826**

3 **5/3-way proportional valve**
The proportional directional control valve converts an analog electrical input signal into corresponding opening cross sections at the outputs.
– Operating medium: filtered, unlubricated compressed air (5 µm filtration grade)
– Nominal/maximum pressure: 600 – 1000 kPa (6 – 10 bar)
– Max. nominal flow rate: 700 l/min
– Operating voltage: 24 V DC
– Analog setpoint voltage: 0 - 10 V DC
– Power consumption: 2 W (piston in mid-position)
– Power consumption: 20 W (max. value)
– Hysteresis: max. 0.4%
– Cut-off frequency: 100 Hz
– Quick-action mounting system Quick-Fix

Order no. **167078**

4 **Pressure regulator valve with pressure gauge**
Control valve with pressure gauge, adjustable via rotary knob with latch, push-in fitting for plastic tubing with O.D. 4 mm.
– Standard nominal flow rate: 110 l/min
– Max. input pressure: 1000 kPa (10 bar)
– Control pressure: 50 – 700 kPa (0.5 – 7 bar)
– Quick-action mounting system Quick-Fix

Order no. **539756**

5 **Proportional-pressure regulator**
Proportional-pressure regulator with connecting cable with safety plugs for installation on profile plates. The valve supplies pressure (15 – 600 kPa (0.15 – 6 bar)) proportional to the input voltage (0 – 10 V).
– Operating voltage: 21.6 – 26.4 V/3.6 W
– Residual ripple: 10%
– Electrical setpoint value: 0 – 10 V
– Input pressure: 700 – 800 kPa (7 – 8 bar)
– Pressure regulation range: 15 – 600 kPa (0.15 – 6 bar)
– Flow rate: 600 l/min
– Quick-action mounting system Quick-Fix

Order no. **539779**

Pneumatics

Flow Control and Shut-off Valves

1 **Flow control valve**
– Standard nominal flow rate: 85 l/min
– Push-in fitting connection for plastic tubing with O.D. 4 mm.
Order no. **193972**

2 **Non-return valve**
– Standard nominal flow rate: 136 l/min
– Push-in fitting connection for plastic tubing with O.D. 4 mm.
Order no. **153462**

3 **Non-return valve, piloted**
As long as there is a control signal at the non-return valve, the compressed air flows to and from the cylinder. If the control signal is removed, the non-return valve blocks the cylinder exhaust air and thus stops the cylinder movement. The valve can be used for positioning and braking functions.
– Operating pressure: 50 – 1000 kPa (0.5 – 10 bar)
– Standard nominal flow rate: 108 l/min
Order no. **540715**

4/5/6 **One-way flow control valve**
The one-way flow control valve is a combination of a flow control valve and a non-return valve. The throttle cross-section can be adjusted with a knurled screw.
– Pressure range: 20 – 1000 kPa (0.2 – 10 bar)
– Standard nominal flow rate:
  – In the flow control direction: 0 – 85 l/min
  – Against the flow control direction: 100 – 110 l/min
Order no. **193967**

5 **One-way flow control valve**
– Quick-action mounting system Quick-Fix
Order no. **560159**

6 **One-way flow control valve**
– Quick-action mounting system Quick-Fix
Order no. **152881**

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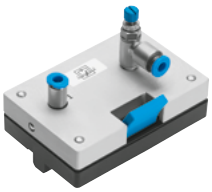

Pneumatics

Flow Control and Shut-off Valves

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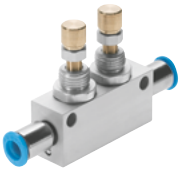

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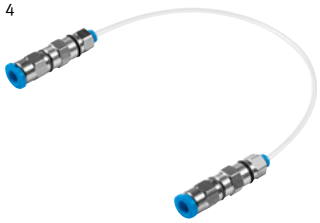

1 **Double one-way flow control valve**
Used for controlling the flow rate. The flow control screws enable the flow rate to be continuously adjustment in either flow direction. In the reverse direction, the air flows through a non-return valve with full cross-section.
– Pneumatic connection, via push-in fitting for plastic tubing with O.D. 4 mm.
– Standard nominal flow rate in flow control/non-return direction: 90/70 l/min

Order no.	**548634**

2 **Quick-exhaust valve**
Quick-exhaust valve, with integrated silencer.
– Design: Poppet valve
– Standard nominal flow rate: 1 – 2; 2 – 3: 300 l/min; 390 l/min

Order no.	**539772**

3 **Pneumatic resistor, long**
The component functions as a pneumatic resistor. Thanks to the small diameter and long length of the tubing, the two key features of pneumatic tubing and how they affect the flow rate and system behavior can be examined.
– Tubing diameter: O.D. 2 mm
– Tube length: 12 m
– Pneumatic connection, via push-in fitting for plastic tubing with O.D. 4 mm.
– Quick-action mounting system Quick-Fix

Order no.	**4646991**

4 **Pneumatic resistor, short**
The component functions as a pneumatic resistor. Thanks to the small tubing diameter, the effects on the volumetric flow rate and system behavior can be examined.
– Tubing diameter: O.D. 2 mm
– Tube length: 10 cm
– Pneumatic connection, via push-in fitting for plastic tubing with O.D. 4 mm.

Order no.	**4809992**

Pneumatics
Control Valves

1 **AND valve**
The dual pressure valve is switched through to the output by connecting the compressed air to the two inputs (AND function).
– Design: AND gate (AND valve)
– Pressure range: 100 – 1000 kPa (1 – 10 bar)
– Standard nominal flow rate: 1, 1/3 – 2: 550 l/min

Order no.	**539770**

2 **Shuttle valve (OR)**
The shuttle valve is switched through to the output by connecting the compressed air to one of the two inputs (OR function).
– Type: OR gate (shuttle valve)
– Pressure range: 100 – 1000 kPa (1 – 10 bar)
– Standard nominal flow rate: 1, 1/3 – 2: 500 l/min

Order no.	**539771**

3 **Pneumatic timer, normally closed**
Pneumatic timer (delay valve). The timer switches the input pressure applied to connection 1 to connection 2 after the set time delay has expired. The time delay can be continuously adjusted between 2 and 30 s using an adjusting knob .

Order no.	**540694**

4 **Pneumatic timer, normally open**
Pneumatic timer (delay valve). In the idle position, port 1 is connected through to port 2. The pneumatic timer is started by a pneumatic signal at the control port. After the set delay time has elapsed, it is reversed and reset to the initial position by a return spring after the signal has been removed. The time delay can be continuously adjusted between 2 and 30 s using an adjusting knob .

Order no.	**539759**

5 **Pneumatic preset counter**
The counter counts pneumatic signals backwards from a preset number. Once the zero position is reached, the counter gives a pneumatic output signal.
– Type: Mechanical counter with pneumatic drive
– Display: 5-digit, digit size 4.5 mm
– Reset: Manual button or pneumatic signal
– Pressure range: 200 – 800 kPa (2 – 8 bar)
– Min. pulse length for actuator: 10 ms
– Min. pulse length for reset: 180 ms
– Counting frequency continuous operation: 2 Hz

Order no.	**152877**

6 **Pressure sequence valve**
The pressure of the control signal is infinitely adjustable with a pressure adjustment screw.
– Design:
Poppet valve with spring return
– Operating pressure range:
180 – 800 kPa (1.8 – 8 bar)
– Pilot pressure range:
100 – 800 kPa (1 – 8 bar)
– Standard nominal flow rate 1 – 2:
100 l/min
– Quick-action mounting system Quick-Fix

Order no.	**152884**

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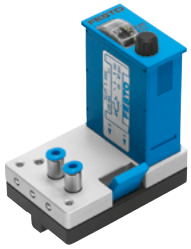

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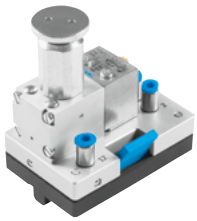

Pneumatics

Control Valves/Vacuum Technology

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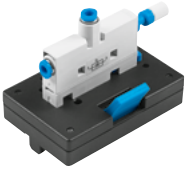

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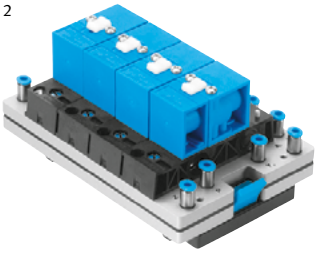

1 **Back pressure valve**
The back-pressure valve with tappet control is actuated by the flat surface of the cylinder cam. The supply pressure can be regulated by a flow control valve.
– Supply pressure range: 0 - 800 kPa (0 - 8 bar)
– Closing force at 600 kPa (6 bar): 12.5 N

Order no. **152868**

2 **Stepper module**
– Design: Poppet valve with integrated AND and OR gate
– Standard nominal flow rate P – A: 60 l/min
– Pressure range: 200 – 800 kPa (2 – 8 bar)

2 Stepper module, consisting of three TAA modules and one TAB module.

Order no. **152886**

Stepper module, expansion
Consisting of four TAA building blocks

Order no. **152885**

3/4/5 **Vacuum generator**
– Operating pressure 100 – 800 kPa (1 – 8 bar)
– Nominal diameter of de Laval nozzle 0.45 mm
– Connections with push-in fittings for plastic tubing with O.D. 4 mm
– With plug-in silencer
– Quick-action mounting system Quick-Fix

3 **Vacuum generator, type H**
– Nominal operating pressure 450 kPa (4.5 bar)
– Maximum suction volume flow against atmosphere 6.2 l/min
– Maximum vacuum 88%

Order no. **573258**

4 **Vacuum generator, type L**
– Nominal operating pressure 600 kPa (6 bar)
– Maximum suction volume flow against atmosphere 15.7 l/min

Order no. **573259**

5 **Vacuum generator, type M**
– Nominal operating pressure 600 kPa (6 bar)
– Maximum suction volume flow against atmosphere 6.1 l/min
– Maximum vacuum 86%

Order no. **548628**



Pneumatics
Drives/Actuators

1 **Single-acting cylinder**
Single-acting cylinder with trip cam.
– Operating pressure: maximum 1000 kPa (10 bar)
– Stroke length: maximum 50 mm
– Thrust at 600 kPa (6 bar): 169 N
– Spring return force: minimum 13.5 N

Order no.	**152887**

2/3 **Double-acting cylinder**
Double-acting cylinder with trip cams. The end position damping can be set using two adjusting screws. The piston has a permanent magnet attached to it, with a magnetic field that can be used to activate the proximity switches.
– Operating pressure: maximum 1000 kPa (10 bar)
– Stroke length: maximum 100 mm
– Thrust at 600 kPa (6 bar): 189 N
– Retraction force at 600 kPa (6 bar): 158 N

Order no.	**152888**

3 **Double-acting cylinder, low friction**

Order no.	**4809915**

4/5 **Cover for cylinder**
Reduces the risk of injury. With ruler for easy positioning of limit switches and proximity switches. Also suitable for a cylinder with mounting kit. Use two covers for cylinders with a stroke longer than 200 mm. For all differential andconstant steady-speed cylinders.
– Quick-action mounting system Quick-Fix

Order no.	**556290**

5 **Cover for cylinder**
Suitable for cylinders order no. 152887, 152888 and 549832 with weight order no. 572778, as well as cylinders order no. 152857 without weight. The position of the cover can be queried, for example, with electrical limit switches order no. 183322 and 183345.

Order no.	**572777**

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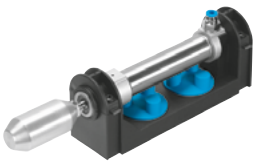

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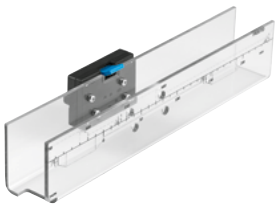

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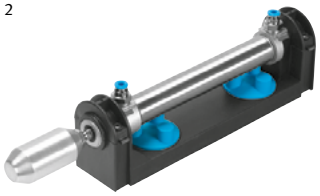

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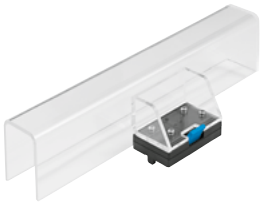

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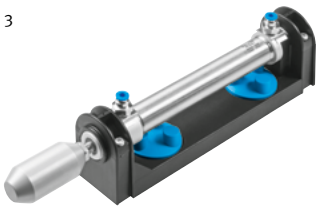

Pneumatics
Drives/Actuators

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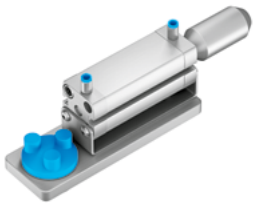

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1 **Double-acting profile cylinder**
Double-acting compact cylinder with trip cams. The piston has a permanent magnet attached to it, with a magnetic field that can be used to activate the proximity switches. There are slots on three sides to accommodate proximity switches. Integrated cushioning pads absorb the residual energy in the end positions.
– Operating pressure: maximum 1000 kPa (10 bar)
– Piston diameter: 20 mm
– Theoretical thrust at 600 kPa (6 bar): 188 N
– Theoretical retraction force at 600 kPa (6 bar): 141 N

Order no. **549832**

2 **Weight, 2 kg, for cylinder**
With plain-bearing guide and fastening material for mounting on cylinders with M8 thread.

Order no. **572778**

3 **Driving/tractive load**
Demonstration of a driving or tractive load. Consisting of a double-acting cylinder, a weight of 6 kg, and two fixed throttles. It is attached to the profile plate with 2 T-head nuts.
– Operating medium: dried air, lubricated, or unlubricated
– Operating pressure: 100 – 1000 kPa (1 – 10 bar)
– Damping length: 17 mm
– Retraction force at 600 kPa (6 bar) (return): 158.3 N
– Thrust at 600 kPa (6 bar) (flow): 188.5 N
– Mode of operation: double-acting
– Impact energy in the end positions: 0.2 J

Order no. **152889**

4 **Stop, 35 mm adjustment path**
Enables an adjustable end position of the piston rod with fixed stop within the stroke range of a cylinder
– Load max. 200 N (at 600 kPa (6 bar))
– Quick-action mounting system Quick-Fix

Order no. **548630**

Pneumatics
Drives/Actuators

1 **Semi-rotary drive, size 16, 180°**
Quarter-turn actuator with rotating plate for adapting weights (order no. 548581) for load simulation.
– The swivel angle of the actuator is freely adjustable from 0 - 180
– Mounting position freely adjustable from 0 - 90
– Three adapters for mounting proximity switches (order no. 2342009)
– Flexible damping at both ends
– Pneumatic connection, via push-in fitting for plastic tubing with O.D. 4 mm.
– Quick-action mounting system Quick-Fix

Order no.	**544313**

2 **Weight, 175 g**
Set of two weights (2x 175 g) for the quarter turn actuator

Order no.	**548581**

3 **Fluidic muscle, size 10**
With mounting accessories for adaptation to two double-acting cylinders

Order no.	**544311**

4 **Visual display (red)**
– The pneumatically actuated visual indicator responds when a pressure of more than 150 kPa (1.5 bar) is present.
– Design: Reflection principle
– Display color: red
– Pressure range: 150 – 800 kPa (1.5 – 8 bar)
– Quick-action mounting system Quick-Fix

Order no.	**152893**

5 **Compressed air motor**
The motor converts pneumatic energy into mechanical, rotational energy, and can be operated both clockwise and counterclockwise.
– Operating pressure: 300 – 600 kPa (3 – 6 bar)
– Nominal rotational speed: 975 rpm
– Flywheel
– Increments for opto sensor: 1/rev and 12/rev
– Pneumatic connection, via push-in fitting for plastic tubing with O.D. 4 mm.
– Quick-action mounting system Quick-Fix

Order no.	**4645172**

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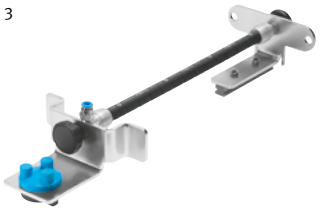

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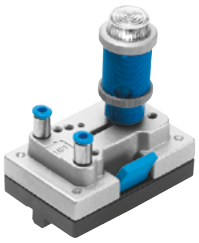

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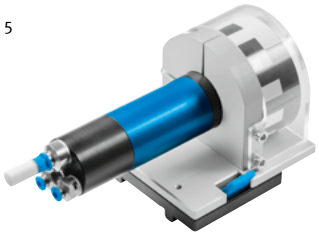

Pneumatics
Drives/Actuators

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1 **Air bearing**
The air bearing consists of an aluminum disc with a supply air duct and a large cavity. When pressurized, the disc glides along a thin film of air and can be moved without friction.
– Pneumatic connection, via push-in fitting for plastic tubing with O.D. 4 mm.

Order no. **4809899**

2/3/4/5/6/7/8 **Suction gripper**
– With suction cup holder and handle
– Connection via push-in fitting for plastic tubing with O.D. 4 or 6 mm.

2 **20 CS with vacuum security valve**
– Diameter: 20 mm
– Protective bellows assembly: 3.5-fold
– Suction cup material: VMQ

Order no. **573047**

3 **Suction gripper 20 SN**
– Diameter: 20 mm
– Suction cup material: NBR

Order no. **573043**

4 **Suction gripper 20 SS**
– Diameter: 20 mm
– Suction cup material: VMQ

Order no. **573045**

5 **Suction gripper 30 SN**
– Diameter: 30 mm
– Suction cup material: NBR

Order no. **573044**

6 **Suction gripper 30 SS**
– Diameter: 30 mm
– Suction cup material: VMQ

Order no. **573046**

7 **Suction gripper 4x20 ON**
– Design of oval suction cup: 4 x 20 mm
– Suction cup material: NBR

Order no. **573257**

8 **Suction gripper, 10 mm diameter**
– rotatable 360°, detenting every 15°
– Suction cup diameter: 10 mm
– Breakaway force at 70 % vacuum: 4.5 N
– Quick-action mounting system Quick-Fix

Order no. **560158**

Pneumatics
Drives/Actuators

Connecting cable for linear potentiometer
Order no. **8201555**

1 **Linear drive, pneumatic, with guide and accessories**
Rodless linear drive with guide.
– Space-saving, rodless linear drive with recirculating ball bearing guide
– Double-acting cylinder
– Adjustable end position cushioning at both end positions
– There is a permanent magnet on the piston. This permits contactless sensing of intermediate and end positions of the drive

– Damping type: pneumatic buffering, adjustable
– Damping length: 18 mm
– Protection against torsion: guide
– Stroke length: 450 mm
– Overall length: 650 mm
– Pressure range: 200 – 800 kPa (2 – 8 bar)
– Connection/thread type: Thread G1/8“
– Effective force (theoretical) at 600 kPa (6 bar): 295 N
– Including connection and mounting materials
Order no. **192501**

2 **Linear potentiometer**
(Displacement encoder)
Analog displacement encoder for pneumatic linear drive (order no. 192501) for determining the current (actual) position. When ordering separately, please also order mounting material (order no. 160275). The connecting cable (order no. 8201555) is required for use with TP 111.
– Measuring stroke: 450 mm
– Output signal at the cable exit of the connecting cable (order no. 8201555): 0–10 V

Push rodless sliding potentiometer which supplies an output voltage proportional to the slider position.
– Operating voltage: 13–30 V
– Effective electrical stroke: 457 mm
– Output voltage: 0–10 V
– Adjustment speed: ≤10 m/s
– Adjustment acceleration: ≤200 m/s²
Order no. **152628**

Mounting kit for linear potentiometer
Order no. **8201548**

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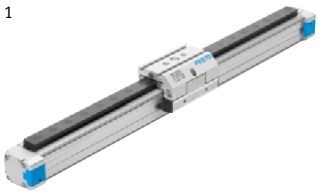

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Pneumatics
Drives/Actuators

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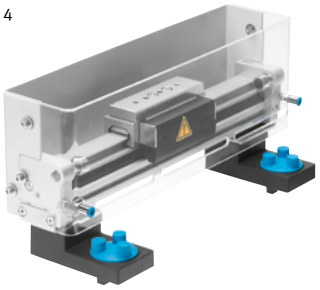

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1 **Ruler**
Two-sided ruler with a printed millimeter scale and two knurled screws. The ruler is used to measure the position of the slide of a linear drive (order no. 192501).
– Overall length: 580 mm
– Scale length: 450 mm
– 2 knurled screws
Order no. **525927**

2 **Weight, 5 kg, for linear drive**
Weight for mounting on the linear drives (order no. 8028726 and order no. 192501), can be used as an additional load.
Order no. **34065**

Adapter for Y-axis or weight
Adapter for mounting the weight on the pneumatic linear actuator.
Order no. **167032**

3 **Shock absorber**
Self-adjusting hydraulic shock absorber for even deceleration. Suitable for pneumatic linear actuators (order no. 192501). Please order the shock absorber retainer (order no. 152908) when ordering individually.
– Stroke: 12 mm
– Impact speed maximum 3 m/s
Order no. **34572**

4 **Linear drive, size 18, 170 mm stroke**
Stroke with plain-bearing guide, elastic damping rings and protective hood
Order no. **548641**

5 **Weight, 2 kg**
For the linear drive (order no. 548641)
Order no. **548582**

Pneumatics
Tubing, Distribution

1 **Start-up valve with filter control valve, 5 µm**
Filter control valve with pressure gauge, start-up valve, push-in fittings, and quick coupling plug, mounted on a swivel mount. The filter with water separator removes dirt, pipe sinter, rust, and condensed water. The pressure regulator maintains the compressed air supply at the set operating pressure and compensates for pressure fluctuations. The filter bowl has a condensate drain screw. The start-up valve pressurizes and exhausts the connected pressure zone. The start-up valve is operated using the rotary knob.

– Design: Sintered filter with water separator, piston control valve
– Primary pressure: Maximum 1600 kPa (16 bar)
– Working pressure: Maximum 1200 kPa (12 bar)
– Grade of filtration: 5 µm
– Condensate volume: 43 cm^3
– Connection: G1/8" and for plastic tubing with O.D. 6 mm

Order no.	**526337**

2 **Start-up valve with filter control valve**
Filter control valve with pressure gauge and start-up valve mounted on a swivel support. The start-up valve pressurizes and exhausts the connected pressure zone.
– Design: Sintered filter with water separator, piston control valve
– Standard nominal flow rate: 110 l/min
– Pressure regulation range: 50 – 700 kPa (0.5 – 7 bar)
– Grade of filtration: 5 µm
– Connection: G1/8" and for plastic tubing with O.D. 6 mm

Order no.	**540691**

3 **Start-up valve with filter control valve, lockable**
Filter control valve with pressure gauge and start-up valve mounted on a swivel support. The start-up valve pressurizes and exhausts the connected pressure zone. The lockable start-up valve reliably prevents unauthorized activation.
– Design: lockable start-up valve, filter regulator with pressure gauge, start-up valve
– Standard nominal flow rate: 750 l/min
– Operating pressure: 100 – 1000 kPa (1 – 10 bar)
– Grade of filtration: 40 µm
– Connection: G1/8" and for plastic tubing with O.D. 6 mm

Order no.	**4795290**

4 **Plastic tubing**
Particularly flexible and pressure-resistant

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: 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**

5 **Air reservoir**
The air reservoir with detenting system can be mounted on a profile plate. The accumulator is equipped with pneumatic push-in fittings at both ends.
Functions:
– Generating static pressures using a one-way flow control valve
– Generating long delay times using delay and flow control valves
– Compensating for pressure fluctuations
– Use as an accumulator if the pressure suddenly drops
– Generating a controlled system with a first-order delay (PT1)

– Operating medium: filtered, lubricated, or unlubricated compressed air
– Operating pressure: 0 – 1600 kPa (0 – 16 bar)
– Connection: Connection: on both sides for plastic tubing with O.D. 4 mm
– Quick-action mounting system Quick-Fix

5 **Air reservoir, 0.4 l**
– Volume: 400 ml

Order no.	**152912**

Air reservoir, 0.1 l
– Volume: 100 ml

Order no.	**573281**

6 **Manifold**
Manifold with eight self-setting non-return valves. Thanks to a combined connection (for plastic tubing with O.D. 6 mm), the compressed air can be supplied to the control unit via eight individual connections (for plastic tubing with O.D. 4 mm).

Order no.	**152896**

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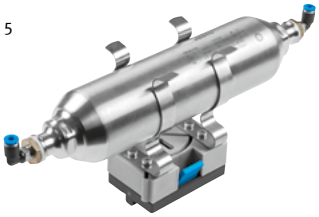

6


Pneumatics

Sensors/Measurement Technology

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1 **Pressure gauge**
The pressure gauge indicates pressure within pneumatic control systems.
– Type: Bourdon tube pressure gauge
– Display range: 0 – 1000 kPa (0 – 10 bar)
– Quality class: 1.6
– Quick-action mounting system Quick-Fix

Order no. **152865**

2 **Vacuum gauge**
– Adjustable red/green range
– Display range/operating pressure: –100 – 0 kPa (–1 – 0 bar)
– Quick-action mounting system Quick-Fix

Order no. **573042**

3 **Pressure sensor with display**
Piezoresistive relative pressure sensor with LCD display, freely programmable switching function, adjustable hysteresis, and analog output for direct measured data acquisition.
– rotatable 210°, detenting every 15°
– Operating voltage: 15 – 30 V DC
– Switching output PNP
– Analog output: 0 – 10 V DC
– Connection, pneumatic for plastic tubing with O.D. 4 mm
– Pressure measuring range: 0 – 1000 kPa (0–10 bar)
– Quick-action mounting system Quick-Fix

Symbols as per IEC standard
Order no. **572745**
Symbols as per NEMA standard
Order no. **8062966**

4 **Proximity switch, electronic, with cylinder mounting**
Magneto-resistive proximity switch, magnetically actuated
– Connection via 4 mm safety sockets
– Switching output: NO (PNP) with switching status indication
– Overload and short-circuit proof, with reverse polarity protection
– Operating voltage: 5 – 30 V DC
– Output current: max. 100 mA
– Switching time (on/off): max. 1 ms
– Mounting system for cylinder diameter 20 mm, 2x sensor slot 8 for simultaneous mounting of one pneumatic and one electronic proximity switch

Order no. **2344752**

5 **Proximity switch, pneumatic, with cylinder attachment**
3/2-way valve, normally closed, solenoid operated
– Connection, pneumatic for plastic tubing with O.D. 4 mm
– Pressure range: 200 – 800 kPa (2 – 8 bar)
– Switching time (on/off): 22 ms/52 ms
– Visual switching status indication
– Mounting system for cylinder diameter 20 mm, 2x sensor slot 8 for simultaneous mounting of one pneumatic and one electronic proximity switch

Order no. **2764815**

Cylinder mounting for pneumatic and electronic proximity switches
Mounting system for cylinder diameter 20 mm, 2x sensor slot 8 for simultaneous mounting of one pneumatic and one electronic proximity switch.
Proximity switch not included in the scope of delivery.

Order no. **8201547**

6 **Pressure sensor, analog**
The analog pressure sensor is a piezo-resistive relative pressure transducer with integrated amplifier and built-in temperature compensation in an aluminum housing.
– Measured variable: relative pressure
– Measurement method: piezo-resistive pressure sensor
– Pressure measuring range: 0 – 1000 kPa (0–10 bar)
– Max. pressure: 1400 kPa (14 bar)
– Operating voltage: 12 – 30 V DC
– Analog output: 0 – 10 V, 0 – 20 mA
– Total error: ±1% of end value
– Operating medium: filtered compressed air, grade of filtration 40 µm
– Electrical connection: 4 mm safety sockets
– Maximum frequency: 100 Hz
– Electrical protection: short-circuit proof, protected against reverse polarity
– Pneumatic connection: for plastic tubing with O.D. 4 mm
– Quick-action mounting system Quick-Fix

Sensor provides a signal even for pressures <0 bar. Linearity and proportionality are not guaranteed.

Order no. **167094**

Pneumatics
Sensors/Measurement Technology

1 **Flow sensor, 0.5 – 50 l/min, analog**
– Rotatable 90°, detenting
– Electrical connection: M12x1, 5-pin for connecting cable with M12 socket and 4 mm safety plugs
– Switching output: 2 x PNP
– Analog output: 0 – 10 V
– Operating voltage: 12 – 30 V DC
– Switching element function switchable
– Switching function freely programmable
– Flow rate measuring range: 0.5 – 50 l/min
– Pneumatic connection: for plastic tubing with O.D. 4 mm
– Quick-action mounting system Quick-Fix

Order no.	**8036235**

2 **Force sensor**
Force sensor for piston force measurement in TP 210. It is mounted on a profile plate using two T-head nuts. Electrical connection is via a 4 mm safety plug.
– Measuring range: 0–1 kN
– Operating voltage: 24 V DC
– Output voltage: 0–10 V

Order no.	**539780**

3 **Flow indicator with float, pneumatic**
Mechanical flow indicator according to the float principle for measuring flow in standard liters, i.e., against atmospheric pressure.
– Operating pressure: 100 – 800 kPa (1 – 8 bar)
– Measuring range: 30 – 200 SLPM, 1 – 7 SCFM
– Connection, pneumatic for plastic tubing with O.D. 4 mm
– The vertical position of the indicator can be adjusted without tools via a swivel mechanism
– Quick-action mounting system Quick-Fix

Order no.	**4741762**

4 **Spring load for cylinder, pneumatic**
The spring load is installed on the double-acting cylinder (order no. 152888). The cylinder compresses the spring in the forward stroke. The stroke and force of the cylinder can be read off the scale.
– Measuring range: Stroke 0 – 50 mm/0 – 2 in. and force 0 – 230 N/0 – 50 lbf
– Quick-action mounting system Quick-Fix

Order no.	**4646789**

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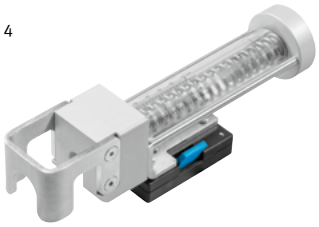

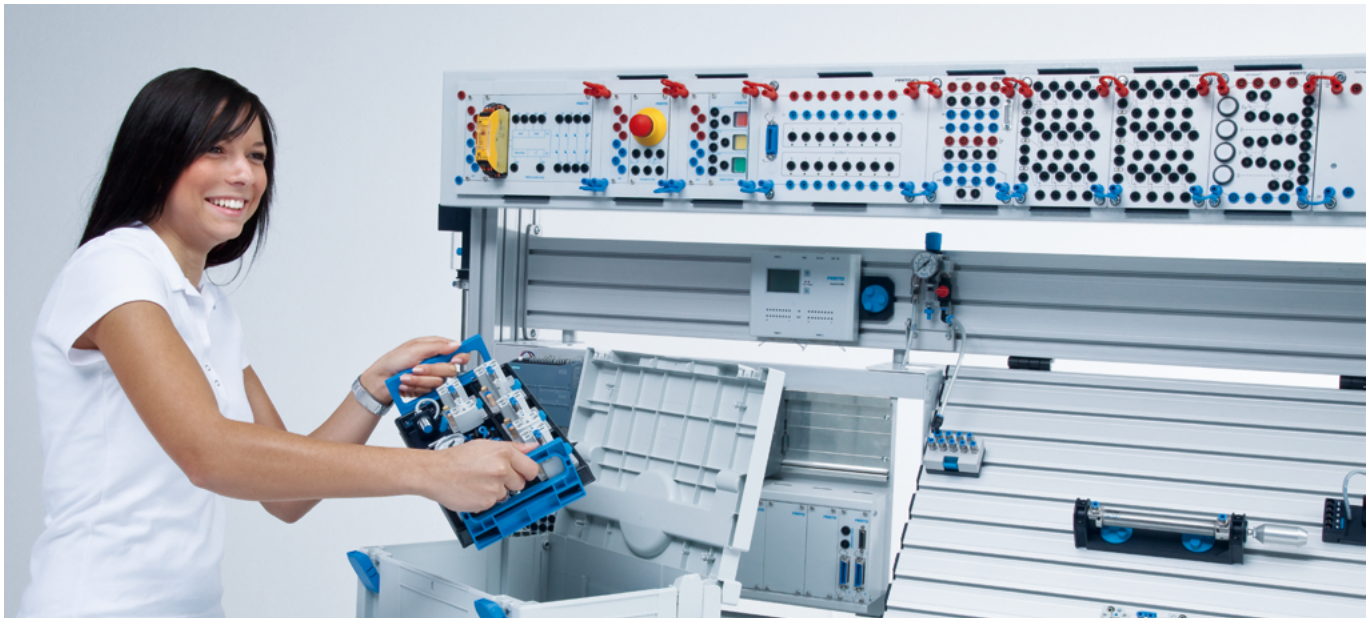

Pneumatics
Accessories and Optional Components

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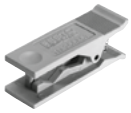

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CEE 7/VII


NEMA 5-15


1 **Push-in fittings/push-in connectors**
For quickly creating branch lines with little effort, for plastic tubing, O.D. 4 mm (calibrated).
– Simply “plug and work”
– Flexible installation—all fittings can be rotated 360° around the threaded coupling
– Absolutely safe and tight—with NBR plastic sealing ring
– Reusable—thread with self-sealing coating

Minimum order quantity/packaging unit: 10 items

Straight fitting, M5 (QSM-M5-4)
Order no. **153304**
Straight fitting, G1/8 (QS-G1/8-4)
Order no. **186095**
Angle fitting, rotatable, M5 (QSML-M5-4)
Order no. **153333**
Angle fitting, rotatable, G1/8 (QSL-G1/8-4)
Order no. **186116**
Angle fitting, 4H (QSL-4H)
Order no. **153056**
Straight fitting, self-adjusting, M5 (QSK-M5-4)
Type 6 **153291**
Straight fitting, self-adjusting, G1/8 (QSK-G1/8-4)
Order no. **186294**
T-distributor (QST-4)
Order no. **153128**
T-distributor (QST-6)
Order no. **153129**
Push-in bulkhead fitting, (QSMS-4)
Order no. **153376**
Blanking plug (QSC-4H)
Order no. **153267**
Push-in sleeve (QSH-4)
Order no. **153251**
Push-in connector (QSM-6H-4)
Order no. **153329**

2 **Pipe and tubing cutter**
For pneumatic tubing made of plastic and NBR with and without fabric insert up to O.D. 20 mm Right-angled, burr-free cut thanks to form-fitting support of the tubing in the cutter. It also has an integrated safety bar to prevent accidental opening. Delivery includes two spare blades
Order no. **7658**

3 **Tubing cutter**
For cutting pneumatic polymer tubing cleanly to length.
Order no. **8201524**

Releasing tool for pneumatic tubing
For loosening all pneumatic QS connecting components with tubing O.D. from 3 to 10 mm
Order no. **158419**

Silencer and sealing rings
Minimum order quantity/packaging unit: 10 items

Sealing ring OL-M5
Order no. **34634**
Silencer U-1/8
Order no. **2307**
Sealing ring OL-1/8
Order no. **33840**

4 **Compressor**
Sound pressure of only 41 dB(A), so well suited for use in classrooms. Complete with pressure regulator, water separator, 5 m compressed air tube with O.D. 6 mm, 3 T-distributors.
– Pressure: maximum 400 kPa (4 bar)
– Suction capacity: 14 l/min
– Reservoir capacity: 2.5 l
– Dimensions: 310 x 150 x 370 mm

Version: 230 V/50 Hz
With IEC power cable as per CEE 7/VII suitable for: DE, FR, NO, SE, FI, PT, ES, AT, NL, BE, GR, TR, IT, DK, IR, ID
230 V/50 Hz **548707**
Version: 120 V/60 Hz
With IEC power cable as per NEMA 5-15 suitable for: US, CA, Central America, BR, CO, YU, EC, KR, TW, TH, PH, JP
120 V/60 Hz **556275**

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

Version: 230 V/50 Hz With IEC socket and IEC power cable as per CEE 7/VII suitable for: DE, FR, NO, SE, FI, PT, ES, AT, NL, BE, GR, TR, IT, DK, IR, ID.
230 V/50 Hz **91030**
Version: 120 V/60 Hz With IEC socket and plug as per NEMA 5-15 suitable for: US, CA, Central America, BR, CO, EC, KR, TW, TH, PH, JP
120 V/60 Hz **565440**

Compressor accessories
Consisting of:
– Coupling sockets (KD3-CK-4 and KD4-1/4-A)
– Quick coupling plug (KS4-CK-4)
– Tubing (6 x 1 silver 2.5 m)
Order no. **8201523**

Pneumatics
Other Components

1/2 **Universal adapter**
For mounting pneumatic components to the aluminum profile plate.
– Plug, clamp, ready—without any effort
– No worn out terminal sockets
– Accurate positioning of components
– Working in the third dimension
– The adapters are universally suitable for components with through-hole
– Quick-action mounting system Quick-Fix

Mount the components on the adapter using self-tapping screws—simply, quickly, and reliably. Matching self-tapping screws are included in the scope of delivery. Not suitable for the adaptation of hydraulic components.

3 75 x 50 x 30 mm	**195224**
4 75 x 100 x 30 mm	**195225**

3 **Quick-Fix screw adapter**
The Quick-Fix screw adapter allows components to be attached to a profile plate.

Order no.	**549806**

4 **Quick-Fix clamping adapter**
The Quick-Fix clamping adapter allows small components to be attached to a profile plate.

Order no.	**8026327**

5 **Multiple hose clamping strip set**
Easy to attach to the aluminum profile plate, provides a clear layout with up to 6 tubing pieces/cables per terminal strip. Set with 10 pieces.

Order no.	**544317**

6 **DIN rail set**
Two 300 mm long DIN rails, matching the relay base and the terminal block set with fixing material for adaptation to the aluminum profile plate.

Order no.	**548637**

7 **Cable duct set**
1x 150 mm, 3x 265 mm and 1x 500 mm cable ducts with mounting material for adaptation to the aluminum profile plate.

Order no.	**548638**

8 **Accessory box**
The accessory box for pneumatic fittings contains fitting and tubing accessories, as well as a tubing cutter and a releasing tool.

Order no.	**167020**

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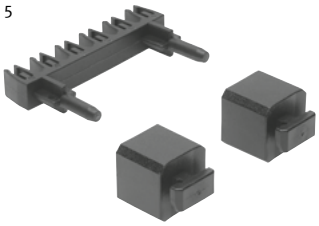

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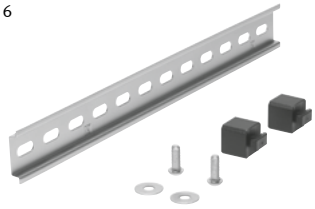

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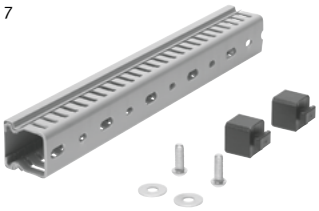

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Hydraulics
Directional Control Valves

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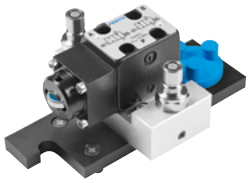

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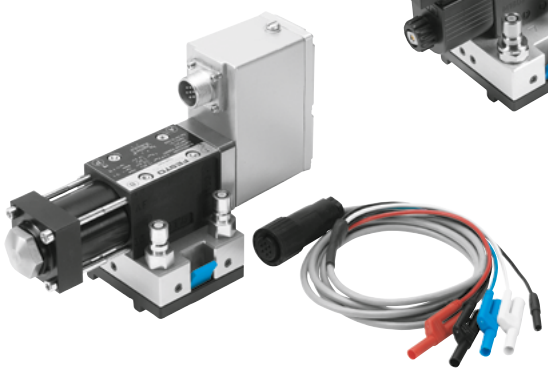

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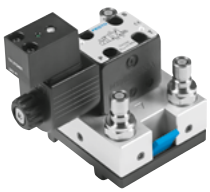

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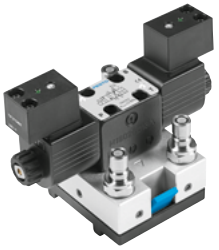

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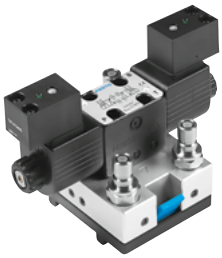

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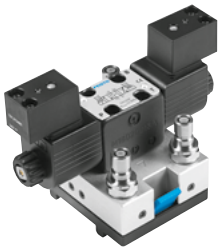

1/2/3/4 **Hand lever valves**
- Actuation: Manual
- Operating pressure: 6 MPa (60 bar)
- Maximum permissible pressure: 12 MPa (120 bar)
- Valve connection diagram, hydraulic ISO/DIN 4401 size 02
- Low-leakage, self-sealing coupling nipples
- Quick-action mounting system Quick-Fix

1 **4/2-way hand lever valve, spring return**
Order no. **544342**

2 **4/3-way hand lever valve, Locking center position, detenting**
Order no. **544343**

3 **4/3-way hand lever valve, Relieving center position (AB->T), detenting**
Order no. **544344**

4 **4/3-way hand lever valve, bypass mid-position (P > T), detenting**
Order no. **544345**

4/3-way hand lever valve, H center-position, detenting (PTAB)
Order no. **8065281**

5 **2/2-way stem actuated valve, convertible**
- Actuation: mechanical, by the guide bar of a cylinder with mounting kit, with spring return
- Rest position: (P->A), convertible
- Operating pressure: 6 MPa (60 bar)
- Maximum permissible pressure: 12 MPa (120 bar)
- Valve connection pattern, hydraulic
- ISO/DIN 4401 size 02
- Low-leakage, self-sealing coupling nipples
- Quick-action mounting system Quick-Fix

Order no. **544353**

6 **4/3-way regulating valve**
Direct-controlled servo valve with electrical position control of the control piston.
- Zero overlap and linear characteristic curve (flow to control piston position)
- Locking device position, de-energized
- Permanent magnet actuation, adjustment by linear motor
- Integrated position, driver, and amplifier electronics
- Operating pressure: 6 MPa (60 bar)
- Maximum permissible pressure: 12 MPa (120 bar), on connection T 5 MPa (50 bar)
- Low-leakage, self-sealing coupling nipples
- Operating voltage: 24 V DC
- Maximum current consumption: 1.2 A
- Setpoint signal ± 10 V DC
- Electrical connection: cable with 4 mm safety plugs
- Quick-action mounting system Quick-Fix

Order no. **567269**

7/8/9/10/11 **Solenoid valves**
- Actuation: Switching solenoid
- Operating pressure: 6 MPa (60 bar)
- Maximum permissible pressure: 12 MPa (120 bar)
- Valve connection diagram, hydraulic ISO/DIN 4401 size 02
- Low-leakage, self-sealing coupling nipples
- Operating voltage: 24 V DC
- Power: 6.5 W
- Connection, electrical: 4 mm safety sockets
- Quick-action mounting system Quick-Fix

7 **4/2-way solenoid valve, spring return**
Order no. **544346**

8 **4/2-way double solenoid valve, detenting**
Order no. **544352**

9 **4/3-way solenoid valve, mid-position closed**
Order no. **544347**

10 **4/3-way solenoid valve, relieving mid-position (AB > T)**
Order no. **544348**

11 **4/3-way solenoid valve, bypass mid-position (P > T)**
Order no. **544349**

Hydraulics
Directional Control Valves

1 **4/3-way proportional valve**
The valve is used to control the direction and quantity of hydraulic volume flows.
– Locking device position, de-energized
– Actuation: Proportional solenoid
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Valve connection diagram, hydraulic ISO/DIN 4401 size 02
– Low-leakage, self-sealing coupling nipples
– Operating voltage: 24 V DC
– Nominal current: 800 mA
– Connection, electrical: 4 mm safety sockets
– Quick-action mounting system Quick-Fix

Order no. **544350**

2 **Pressure balancer (Proportional flow control valve)**
The pressure balancer expands the 4/3-way proportional valve (order no. 544350) into a proportional flow control valve. This vertical stacking valve is mounted between the base plate and the proportional directional control valve.
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Valve connection diagram, hydraulic ISO/DIN 4401 size 02

Order no. **159351**

3 **6/3-way proportional hand lever valve**
The valve is used to control hydraulic volume flows, both in terms of direction and quantity. Serial, parallel, and tandem circuits can be realized by linking several valves.
– Mid-position, spring-centered, P1->T1, P2T2AB locked
– Actuation: Manual
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar), T2 only briefly 6 MPa (60 bar)
– Low-leakage, self-sealing coupling nipples
– Quick-action mounting system Quick-Fix

Order no. **572141**

4 **Load sensing control block**
Two proportional directional control valves with input pressure balancer for load sensing controls (pressure and volume flow adjustment). Suitable for pilot control unit, 2x 2-channel (Order no. 572147).
– Locking center position, spring-centered (closed center)
– Actuation: Hydraulic and manual (hand lever)
– Operating pressure: 6 MPa (60 bar)
– Pilot pressure: up to 3.5 MPa (35 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipples
– Open connection nipple for unpressurized return flow (T)
– Quick-action mounting system Quick-Fix

Order no. **572144**

5 **Steering valve (Orbitrol)**
The rotary slide valve is used for hydrostatic steering systems. When the steering wheel is turned, the steering unit measures a quantity of oil to the right or left that is proportional to the steering wheel rotation. The excess volume flow is discharged via E and fed to another consumer (Power Beyond).
– Without load feedback (non-reaction)
– Open center (for fixed displacement pump)
– Actuation: Manual (steering wheel)
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipples
– Open connector plug for unpressurized return flow (T)
– Quick-action mounting system Quick-Fix

Order no. **572146**

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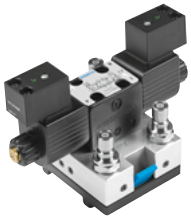

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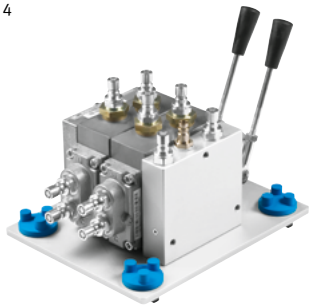

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Hydraulics
Pressure Regulators

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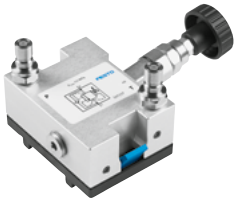

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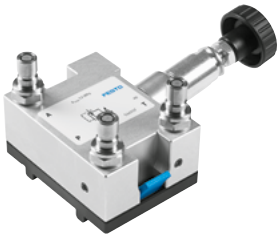

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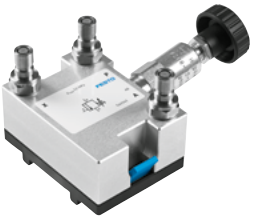

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1 **Pressure relief valve**
The valve limits the pressure at port P to the set value relative to the pressure at T.
– Adjustment: Manual
– Including the non-return valve
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipples
– Quick-action mounting system Quick-Fix

Order no. **544335**

2 **Pressure relief valve, compensated**
The valve limits the pressure at port P to the set value relative to the pressure at T. The pressure on T has no influence on this value, as the spring space of the pressure limiter is balanced.
– Adjustment: Manual
– Including the non-return valve
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipples
– Quick-action mounting system Quick-Fix

Order no. **567237**

3 **Pressure relief valve, piloted**
The valve can limit larger volume flows in pressure than is possible with a directly controlled valve. The valve limits the pressure, corresponding to the spring of the main stage and the pilot pressure at X, from port P to port T.
– Adjustment: Manual
– Hydraulically piloted
– Control pressure accessible through connection X
– Separate tank connection Y of the pilot control stage
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipples
– Quick-action mounting system Quick-Fix

Order no. **8025067**

4 **3-way pressure reducing valve**
The valve keeps the pressure set at port A constant, compensating for fluctuations in supply pressures and consumer loads. If the pressure at A rises above the set value, a connection opens from A to T.
– Adjustment: Manual
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipples
– Quick-action mounting system Quick-Fix

Order no. **544337**

5 **Pressure sequence valve**
The valve connects P to T when the pressure at X is greater than the sum of the spring force and the pressure in connection T.
– Adjustment: Manual
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipples
– Quick-action mounting system Quick-Fix

Order no. **544341**

6 **Proportional pressure relief valve**
The valve is used to limit the pressure. The limiting pressure is adjusted by the proportional solenoid.
– Actuation: Proportional solenoid
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Valve connection diagram, hydraulic ISO/DIN 4401 size 02
– Low-leakage, self-sealing coupling nipples
– Operating voltage: 24 V DC
– Nominal current: 800 mA
– Connection, electrical: 4 mm safety sockets
– Quick-action mounting system Quick-Fix

Order no. **544351**

7 **Counterbalancing valve**
The valve (also known as a counterbalancing valve) ensures controlled lowering speeds of drives. As the control pressure on X increases, the set value of the pressure limitation decreases. A non-return valve flows around the pressure relief valve from T to P.
– Adjustment: Manual (with tool)
– Area ratio of X to P is 1:3
– Including the non-return valve
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipples
– Quick-action mounting system Quick-Fix

Order no. **572149**

Hydraulics
Pressure Regulators

1 **Pilot control unit (joystick), 2x 2-channel**
Each channel has two pressure reducing valves that control the pressure from P to A or B. A and B are depressurized in the spring-centered neutral position. The hydraulic joysticks are used, for example, for remote or pilot control of the load-sensing mobile block.
– Adjustment: Manual (2x joystick)
– Operating pressure: 3.5 MPa (35 bar)
– Maximum permissible pressure: 3.5 MPa (35 bar)
– Low-leakage, self-sealing coupling nipples
– Open connection nipple for unpressurized return flow (T)
– Quick-action mounting system Quick-Fix

Order no.	**572147**

2 **Pressure balancer for open center load sensing**
The valve is required for load-sensing applications with a fixed displacement pump (open center).
– Adjustment: Hydraulic
– Differential pressure: 0.055 MPa (5.5 bar)
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipples
– Quick-action mounting system Quick-Fix

Order no.	**572123**

3 **Pressure balancer, upstream**
This pressure balancer ensures a volumetric flow rate independent of the load pressure.
– Adjustment: Hydraulic
– Differential pressure: 0.055 MPa (5.5 bar)
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipples
– Quick-action mounting system Quick-Fix

Order no.	**573023**

4 **Pressure balancer, downstream**
The pressure balancer ensures the volume flow is independent of the load pressure. If all the consumers together demand more volume flow than can be provided by the pump, the individual volume flows are reduced proportionally. The valve is used in load-sensing applications with an LS variable displacement pump (closed center).
– Adjustment: Hydraulic
– Differential pressure: 35 kPa (0.35 bar)
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipples
– Quick-action mounting system Quick-Fix

Order no.	**572741**

5 **Flush valve with pressure relief valve**
The valve is used to discharge oil in a closed hydraulic circuit.
– Adjustment: Hydraulic and fixed pressure relief valve
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipples
– Quick-action mounting system Quick-Fix

Order no.	**572126**

6 **Shock and anti-cavitation valve**
The valve block contains two pressure relief valves (shock valves) to dissipate pressure peaks to T, and two suction valves to ensure supply to the consumer line even in the event of underpressure, e.g., due to load changes. Manual adjustment.
– Adjustment: Manual
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipples
– Quick-action mounting system Quick-Fix

Order no.	**572148**

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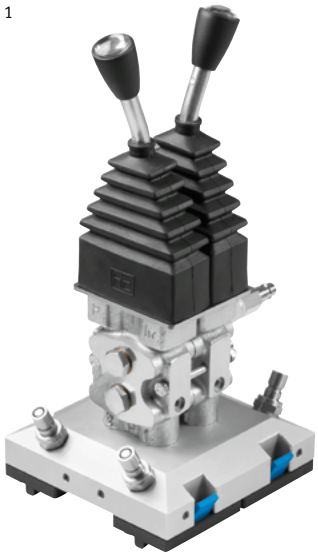

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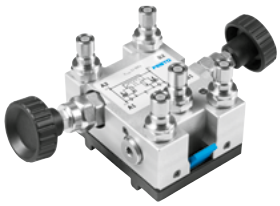

Hydraulics
Flow Control/Shut-off Valves

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1 **Flow control valve**
The valve is used to influence the volumetric flow rate through an adjustable throttle point in both directions.
– Actuation: Manual
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipples/socket

Order no.	**152842**

2 **One-way flow control valve**
The valve is used to influence the volume flow through an adjustable throttle point in one direction. In the opposite direction, the flow control valve is bypassed by the non-return valve.
– Actuation: Manual
– Integrated non-return valve
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipples/socket

Order no.	**152843**

3 **Non-return valve**
The valve is closed by a closing cone which is pressed against the seat by a spring. If the valve opening pressure on the seat side is exceeded, the valve opens and the flow can pass through. If the pressure on the spring side is greater, the valve remains closed.
– Actuation: Hydraulic
– Tube length: 1000 mm
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling sockets

0.05 MPa valve opening pressure

Order no.	**548617**

0.6 MPa valve opening pressure

Order no.	**548618**

4 **Shut-off valve**
The valve can be closed by turning the lever. A ball is pressed onto the seal facing away from the pressure and shuts off the flow of volumetric oil without leakage.
– Actuation: Manual
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipples/socket

Order no.	**152844**

5 **Non-return valve, piloted**
The valve is closed by a closing cone which is pressed against the seat by a spring. The closing cone only opens when X is opened. If the valve opening pressure on the seat side is exceeded, the valve opens and the flow can pass through.
– Actuation: Hydraulic
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipples
– Quick-action mounting system Quick-Fix

Order no.	**544339**

6 **Double non-return valve, piloted**
The two non-return valves are each unlocked from the opposite side.
– Area ratio of control piston to non-return valve seat 3.3:1
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipples
– Quick-action mounting system Quick-Fix

Order no.	**572151**

Hydraulics
Flow Control/Shut-off Valves

1 **2-way flow control valve**
The valve ensures a constant flow rate in the direction of flow from A to B, regardless of the load pressure on B. The oil flows from B to A via the opening non-return valve.
– Actuation: Manual
– Differential pressure of the pressure balancer: 0.55 MPa (5.5 bar)
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipples
– Quick-action mounting system Quick-Fix

Order no. **544338**

2 **3-way flow control valve**
The valve ensures a constant volumetric flow rate in the direction of flow from P to A, regardless of the load pressure on A. The excess volumetric flow rate is diverted via B and can be supplied to another consumer. The excess volumetric flow rate is diverted via B and can be supplied to another consumer.
– Actuation: Manual
– Differential pressure of the pressure balancer: 0.55 MPa (5.5 bar)
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipples
– Quick-action mounting system Quick-Fix

Order no. **572150**

3 **Flow divider**
The valve divides the volumetric flow rate to A and B at a ratio of 50:50, independently of the load.
– Actuation: Hydraulic
– Minimum flow rate: 0.5 l/min
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Valve connection diagram, hydraulic ISO/DIN 4401 size 02
– Low-leakage, self-sealing coupling nipples
– Quick-action mounting system Quick-Fix

Order no. **544340**

4 **Shuttle valve**
The shuttle valve is switched through to the output by pressurizing one of the two inputs (OR function). If both inputs are pressurized, the higher pressure is switched through.
– Actuation: Hydraulic
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipples
– Quick-action mounting system Quick-Fix

Order no. **572122**

5 **Priority valve LS, dynamic**
The valve supplies the flow direction from P to CF preferentially and independently of the load pressure on CF. The excess volume flow is diverted via EF and fed to another consumer.
– Actuation: Hydraulic
– Differential pressure of the pressure balancer: 1.03 MPa (10.3 bar)
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipples
– Quick-action mounting system Quick-Fix

Order no. **573022**

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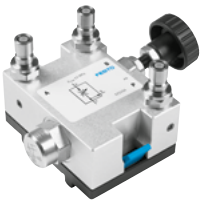

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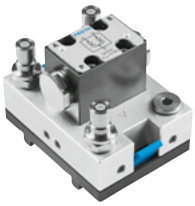

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Hydraulics
Actuators

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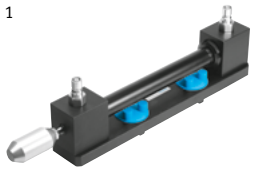

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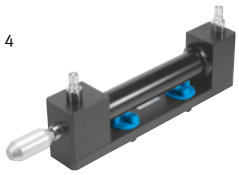

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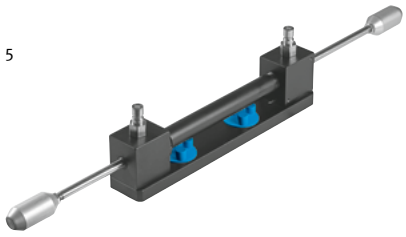

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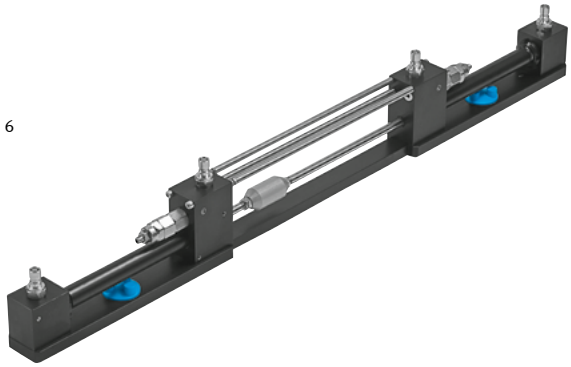

1/2/3/4 **Differential cylinder**
– Piston/piston rod/stroke
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Double-acting
– Low-leakage, self-sealing coupling nipples
– Quick-action mounting system Quick-Fix

1 **16/10/200 with cover**
– Surface area ratio 1:1.6
Order no. **572746**

2 **16/10/300 with cover**
– Surface area ratio 1:1.6
Order no. **572748**

3 **16/10/400 with cover**
– Surface area ratio 1:1.6
Order no. **572749**

4 **25/18/200 with cover**
– Surface area ratio 1:2
Order no. **572747**

5 **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: 2x 10 mm
– Stroke: 200 mm
– Surface area ratio 1:1
Order no. **572750**

6 **Loading unit/ cylinder load simulator**
With this combination, a hydraulic counterforce can be applied to a differential or a constant velocity cylinder. The options are differential against differential (2x 1:1.6), small constant velocity against large constant velocity, or large constant velocity against small constant steady-speed cylinder.
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Integrated overpressure protection
– Double-acting (2x)
– Low-leakage, self-sealing coupling nipples
– Piston Ø: 2x 16 mm
– Piston rod Ø: 10 mm
– Stroke: 200 mm
– Surface area ratio 1:1 or 1:1.6
Order no. **572145**

Hydraulics
Actuators

1 **Driving/tractive load, rotatable**
Weight-loaded hydraulic cylinder with active direction rotatable without tools. The load is guided and cushioned in the end positions. Electronic proximity switches (order no. 2342009) can be used as an option. For mounting on a Learnline profile column or on a vertical profile plate in Learnline Mobile:
– Dimensions: 665 x 190 x 157 mm
– Swivel radius: 340 mm
– Weight: 19 kg, of which 10 kg load
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Double-acting
– Low-leakage, self-sealing coupling nipples
– Piston Ø: 16 mm
– Piston rod Ø: 10 mm
– Stroke: 200 mm
– Surface area ratio 1:1.6
– Pressure buildup through load on piston side: 0.48 MPa (4.8 bar)
– Pressure buildup through load on piston rod side: 0.8 MPa (8 bar)

Order no. **3137005**

2 **Cover for cylinder**
Reduces the risk of injury. With ruler for easy positioning of limit switches and proximity switches. Also suitable for a cylinder with mounting kit. Use two covers for cylinders with stroke of more than 200. For all differential and constant steady-speed cylinders. The adapter (order no. 573272) will also be needed for differential cylinders 25/18/200.
– Quick-action mounting system Quick-Fix

Order no. **556290**

3 **Mounting kit for cylinders**
Attaching a mounting kit to a cylinder provides the following options:
– Activation of the stem actuated valve by the guide bar
– Actuation of proximity switch (order no. 2342009) by the permanent magnet on the guide bar
– Using a displacement encoder

For cylinder 572746, 572750, 572145
Order no. **544371**
For cylinder 572748
Order no. **544372**
For cylinder 572747
Order no. **544373**

4 **Spring load for cylinders, hydraulic**
The spring load is mounted on the differential cylinder 16/10/200 without tools. The cylinder compresses the spring in the forward stroke. The stroke and force of the cylinder can be read off the scale. Used for demonstrating the relationship between pressure and force for the topic "holding a load" and can be used as a piston spring accumulator.
– Measuring range: Stroke 0 – 78 mm/0 – 3.1 in and force 0 – 1200 N/0 – 270 lbf
– Quick-action mounting system Quick-Fix

Order no. **4914138**

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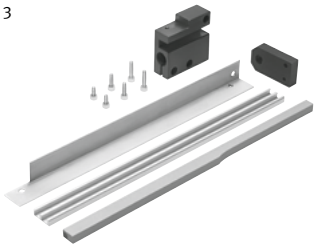

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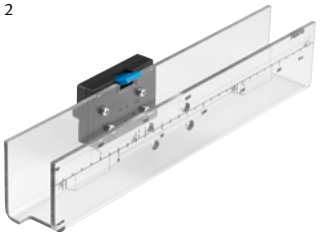

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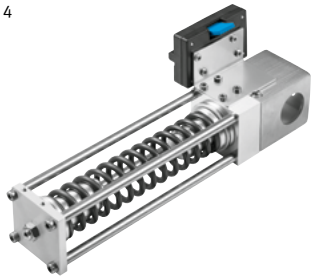



Hydraulics
Actuators

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1/2 **Displacement encoder for cylinder**
Linear potentiometer for mounting on cylinders using a mounting kit.
– Connecting cable with 4 mm safety plug
– Outlet: 0 – 10 V DC

1 **Linear potentiometer with 200 mm measuring stroke**
– For cylinder order no. 572746 and 572750 with mounting kit order no. 544371 or
– For cylinder order no. 572747 with mounting kit order no. 544373

200 mm measuring stroke	**167090**

Linear potentiometer with measuring stroke of 300 mm
For cylinder order no. 572748 with mounting kit order no. 544372

300 mm measuring stroke	**525953**

2 **Linear potentiometer with measuring stroke of 450 mm**
For direct mounting on cylinder order no. 572749 and aluminum profile plate

450 mm measuring stroke	**525954**

3 **Linear drive**
Consisting of slide, double-acting cylinder, covering hood with scale, guide rods, ruler, yoke, and displacement encoder.
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipples
– Mounting accessories
– Piston Ø: 16 mm
– Piston rod Ø: 10 mm
– Stroke: 200 mm
– Surface area ratio 1:1.6

Order no.	**8028726**

4 **Weight, 5 kg, for linear actuator**
Weight for mounting on the linear actuators (order no. 8028726 and 192501), can be used as an additional load.

Order no.	**34065**

Hydraulics
Actuators

1 **Cushioning cylinder for linear actuator**
Load or cushioning cylinder for the linear actuator (order no. 8028726).
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Double-acting
– Low-leakage, self-sealing coupling nipples
– Piston Ø: 16 mm
– Piston rod Ø: 10 mm
– Stroke: 200 mm
– Surface area ratio 1:1.6

Order no. **152295**

2 **Weight, 9 kg for cylinder**
Weight for mounting on a Learnline profile column can be used as a pulling or pushing load on a hydraulic cylinder. With rod clevis and plain-bearing guide.
Weight for cylinder: Order no. 152857, 572746, 572750

Order no. **152972**

3/4 **Cover for weight, 9 kg**
Reliably protects against injuries. Only in combination with cylinder, order no. 152857, 572746, 572750 and weight, order no. 152972.

3 **For the Learntop-S mounting kit**

Order no. **152973**

4 **For the Learnline profile column**

Order no. **541135**

5 **Hydraulic motor**
The motor is set in rotation as the fluid flows through it. As the direction of flow changes, the direction of rotation also changes. The leakage in the motor is fed to the lower pressure side via the shuttle valve.
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Maximum permissible pressure in the return line: 5 MPa (50 bar)
– Displacement volume: 8.2 cm³
– Type: Orbit
– Low-leakage, self-sealing coupling nipples
– Quick-action mounting system Quick-Fix

Order no. **152858**

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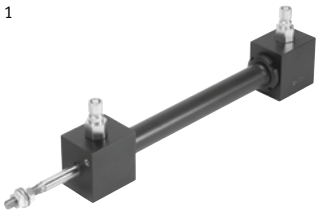

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Hydraulics

Hosing, Distribution/Other Components

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7


1 **Hose line with quick release couplings**
The high-pressure hose is made up of three layers: The inner layer is made of polyamide; the 2nd layer is made of wire mesh, and the cover layer is made of polyurethane. The two quick coupling sockets are self-sealing when decoupled. When used with a coupling nipple, a tightly sealed hydraulic connection forms. During the coupling process, only the front surface of the coupling is wetted with oil. Coupling and uncoupling are only permitted in a depressurized state.
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Temperature range: -40 – +125 °C
– Minimum 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**

Hose line without quick release couplings
With G1/4" external thread and wrench flat (AF19).

Please observe the safety rules of the Employer's Liability Insurance Association for hydraulic high-pressure hose lines. They should not be used for a period exceeding 6 years, including a storage period of no more than 2 years.

600 mm	**8201525**
1000 mm	**8201526**
1500 mm	**8201527**
3000 mm	**8201528**

2/3 **Coupling socket**
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling socket
– G¼“ thread

2 Internal thread	**567223**
3 External thread	**548610**

4 **Coupling nipple**
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipple
– G¼“ external thread

Order no.	**8201529**

Blanking plug
Closes connection threads that are not required.
– Maximum permissible pressure: 12 MPa (120 bar)
– G¼“ external thread

Order no.	**205284**

Sealing ring for blanking plug

Order no.	**34635**

5 **T-distributor**
The T-distributor can be connected at any point.
– Connections: 2x coupling nipple and 1x coupling socket
– Maximum permissible pressure: 12 MPa (120 bar)
– Low leakage oil, self-sealing couplings

Order no.	**152847**

6 **4-way distributor**
– Distributor with five connections
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipples
– Quick-action mounting system Quick-Fix

Order no.	**184455**

7 **4-way distributor with pressure gauge**
The distributor with five connections has a pressure gauge and is firmly screwed onto the profile plate.
– Measuring range and maximum permissible pressure 10 MPa (100 bar)
– Quality class 1.6% of scale end value
– Operating pressure, static: 3/4 of scale end value
– Operating pressure, dynamic: 2/3 of scale end value
– Cushioning: Glycerin
– Low-leakage, self-sealing coupling nipples

Order no.	**159395**

Hydraulics

Hosing, Distribution/Other Components

1 4-way return header, unpressurized
Plate with five connections to combine several safety-relevant return lines. The open quick coupling plug is returned to the tank of the hydraulic power unit.
– Maximum permissible pressure: 1 MPa (10 bar)
– Four self-sealing coupling sockets
– One tube (2 m) with open quick coupling plug

Order no.	**573026**

2 **Tubing line for unpressurized return**
For connecting open connection nipples with the return header or the junction box on the hydraulic power unit.
– Maximum permissible pressure: 1 MPa (10 bar)
– One side with open quick coupling plug, one side with coupling socket
– Length: 1200 mm

Order no.	**573024**

3 **Pressure relief unit**
The pressure relief unit is placed on the low-leakage, self-sealing coupling nipple in order to force it open without great effort. This allows hydraulic pressures that are locked in to be relieved.

Order no.	**152971**

4 **Sub-base**
Sub-bases with four G¼" threaded connections and valve connection patterns to ISO/DIN 4401. For the adaptation of any valves.
– Quick-action mounting system Quick-Fix

Size 02 (NG4) connection pattern, B left, A right	
Order no.	**572152**
Size 02 (NG4) connection pattern, A left, B right	
Order no.	**572153**
Size 03 (NG6) connection pattern, B left, A right	
Order no.	**669198**
Size 03 (NG6) connection pattern, A left, B right	
Order no.	**8201565**

5 **Diaphragm accumulator with shut-off block**
The following functions are available via the three-way ball valve integrated in the shut-off block: 1. Open connection between P and the diaphragm accumulator
2. Closed connection between P and the diaphragm accumulator
3. Open connection between T and the diaphragm accumulator (relief)
– Safety valve against overload
– Pressure gauge for working pressure
– Nominal volume: 0.32 dm³
– Medium, gas side: nitrogen (N)
– Gas filling pressure on delivery: 1 MPa (10 bar)
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipple for P
– Tubing with open quick coupling plug for T

Order no.	**152859**

Accumulator filling device
For filling or refilling the gas side of the diaphragm accumulator (order no. 152859) with nitrogen (N). The accumulator filling device can be operated directly with a commercially available nitrogen cylinder. When using a pressure reducer, manufacturer-specific adapters may be required.

Order no.	**92491**

6 **Pressure filter, 5 µm**
The pressure filter, used directly after the pump, reliably protects downstream hydraulic elements from solids suspended in the oil. The required cleanliness class depends on the most sensitive element in the system.
– Contamination indicator
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipples
– Quick-action mounting system Quick-Fix

Order no.	**548609**

Replacement filter cartridge for the pressure filter

Order no.	**236302**

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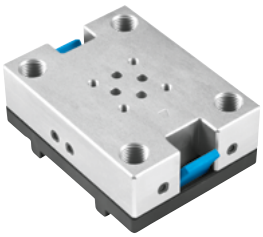

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Hydraulics
Sensors/Measurement Technology

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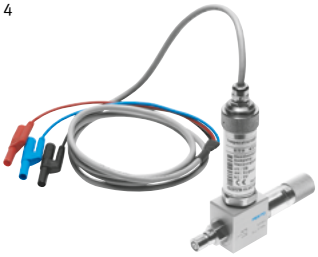

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1 **Pressure gauge**
The pressure gauge can be interconnected at any point for pressure measurement.
– Measuring range and maximum permissible pressure 10 MPa (100 bar)
– Quality class 1.6% of the scale end value
– Operating pressure, static: 3/4 of the scale end value
– Operating pressure, dynamic: 2/3 of the scale end value
– Cushioning: Glycerin
– Low leakage oil, self-sealing couplings

Order no. **152841**

2 Pressure sensor
The pressure sensor can be interconnected at any point for measuring the pressure and has an analog output.
– Operating voltage: 15 – 30 V DC
– Measuring range and maximum permissible pressure 10 MPa (100 bar)
– Analog output: 0 – 10 V
– Electrical connection with 4 mm safety plug
– Low leakage oil, self-sealing couplings

Order no. **525964**

3 **Pressure switch, electronic**
The pressure switch can be interconnected at any point for measuring the pressure, and has two switching outputs and one analog output.
– Operating voltage: 18 – 35 V DC
– Switching outputs 2 x PNP maximum 1.2 A
– Measuring range and maximum permissible pressure 10 MPa (100 bar)
– Analog output: 0 – 10 V
– 4-digit digital display, rotatable on 2 axes
– Electrical connection M12, 5-pin on 4 mm safety plug
– Low leakage oil, self-sealing couplings

Order no. **548612**

4 **Temperature sensor**
The temperature sensor can be interconnected at any point for measuring the temperature and has an analog output.
– Maximum permissible pressure: 12 MPa (120 bar)
– Operating voltage: 20 – 30 V DC
– Measuring range 0 – 100°C
– Analog output: 0 – 10 V
– Electrical connection with 4 mm safety plug
– Low leakage oil, self-sealing couplings

Order no. **525963**

5 **Measuring set**
The complete measuring set is packed in a practical and robust Systainer. It is suitable for commissioning, maintenance, troubleshooting, and optimizing hydraulic circuits.

Complete measuring set, consisting of:
– Flow measuring device, electronic: Analog output 0 - 10 V corresponds to 0 - 10 l/min or 0 - 1220 rpm. The hydraulic motor (order no. 152858) is required for operation. Order no. 567191
– Measuring lead, 500 mm, red: Order no. 376937
– Measuring lead, 500 mm, blue: Order no. 376936
– Digital multimeter: Order no. 8217596
– Pressure sensor, measuring range 0 – 10 MPa (0-100 bar), nominal size 4: Order no. 525964
– Temperature sensor, measuring range 0 - 100 °C, NG 4: Order no. 525963

Order no. **177468**

Hydraulics
Sensors/Measurement Technology

1 **Sight glass flow indicator**
The oil flow and cavitation can be observed through the sight glass. The float acts as an indicator for the flow direction and flow rate.
– Display range up to ± 4 l/min
– Operating pressure: 6 MPa (60 bar)
– Maximum permissible pressure: 12 MPa (120 bar)
– Low-leakage, self-sealing coupling nipples
– Quick-action mounting system Quick-Fix

Order no.	**3492037**

2 **Flow indicator with float**
Mechanical flow indicator according to the float principle for measuring the flow in l/min und gal/min (US).
– Can be used whatever the position, spring return
– Directly readable
– Measuring range: 0.5 – 4.5 l/min or 0.1 – 1.2 gal/min
– Maximum permissible pressure: 12 MPa (120 bar)
– Low leakage oil, self-sealing couplings

Order no.	**4857121**

3 **Measuring container for hydraulic oil**
The transparent measuring container is designed with a calmed inlet, a normal inlet, and an inlet for unpressurized return. There is also a scale, an overflow protection and a drain that can be opened manually. The universal bracket (order no. 539736) is required for mounting to Learnline. Measuring range up to 2 liters.

Order no.	**541134**

4 **Flow sensor**
The sensor is coupled to the hydraulic motor (order no. 152858). A tachogenerator converts the hydraulic motor's speed in rpm into a DC voltage. A speed of 0 to 1220 rpm of the hydraulic motor corresponds to a voltage of 0 to 10 V and a flow rate of 0 to 10 l/min.
– Clockwise/counterclockwise rotation: output as analog value from 0 – 10 V
– Operating voltage: 24 V DC
– Measuring range 0 – 10 l/min
– Analog output: 0 – 10 V
– Electrical connection on 4 mm safety sockets

Order no.	**567191**

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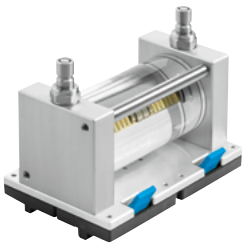

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Hydraulics
Power Units

1



1 **Hydraulic power unit with two independent constant displacement pumps**
Particularly suitable for the individual supply of two hydraulic circuits, each with a separate ON/OFF switch, e.g., on a mobile Learnline workstation. Also recommended for achieving higher cylinder speeds and higher motor speeds. Also ideal for creating characteristic curves for valves.

- Can be integrated into mobile Learnline workstation systems
- Pump design: 2x external gear wheel each with pressure relief valve adjustable from 0 – 6 MPa (0 – 60 bar)
- Operating pressure: 6 MPa (60 bar)
- Two motors with overload protection, each with an ON/OFF switch on Quick-Fix mounting system
- Nominal power: 2x 550 W
- Tank: 40 l, sight glass, temperature display, drain screw
- Tank cap with air filter and return filter
- Low-leakage, self-sealing coupling nipples for P and T
- Connection socket for unpressurized return
- Connecting flange for measuring container return
- Dimensions (W x H x D): 700 x 320 x 550 mm
- Weight: 72 kg (empty)

Alternating current variant, 230 V/50 Hz
- Generator set with AC motors, single-phase and starter capacitors
- Delivery rate 2x 3.4 l/min

Order no. **541114**

Alternating current variant, 120 V/60 Hz
- Power unit with AC motors, single-phase and starter capacitors
- Delivery rate 2x 4.3 l/min (2x 1.1 gpm)

Order no. **8064373**

Three-phase version, 400 V/50 Hz
- Power unit with three-phase motors, three-phase
- Delivery rate 2x 3.4 l/min

Order no. **541116**

All 230 V power units with grounding 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, we always supply the hydraulic units without oil filling. Please order the oil separately

Hydraulics
Power Units

1 **Hydraulic power unit with LS variable and constant displacement pump combination**
Particularly suitable for all tests with the standard equipment sets TP 800 and other mobile hydraulic applications, especially load-sensing (LS) controlled processes.

– Can be integrated into mobile Learnline workstation systems
– Pumps: Axial piston pump with hydraulic load-sensing regulator limited to 4 l/min (1 gpm) flow rate and external gear pump with pressure relief valve adjustable from 0 - 6 MPa (0 - 60 bar)
– Operating pressure: 6 MPa (60 bar)
– Motor with overload protection and an ON/OFF switch on Quick-Fix mounting system
– Nominal power rating: 1.1 kW
– Tank: 40 l volume, sight glass, temperature display, drain screw
– Tank cap with air filter and return filter
– Low-leakage, self-sealing coupling nipples for P and T
– Connection socket for unpressurized return
– Connecting flange for measuring container return
– Dimensions (W x H x D): 700 x 320 x 550 mm
– Weight: 80 kg (empty)

Alternating current variant, 230 V/50 Hz
– Power unit with AC motors, single-phase and starter capacitors
– Delivery rate of the fixed displacement pump 3.8 l/min

Order no. **8065075**

Alternating current variant, 208 V/60 Hz
– Power unit with three-phase motor, three-phase
– Delivery rate of the fixed displacement pump: 4.5 l/min (1.2 gpm)

Order no. **8073527**

Three-phase version, 400 V/50 Hz
– Power unit with three-phase motor, three-phase
– Delivery rate of the fixed displacement pump: 3.8 l/min

Order no: **8065076**

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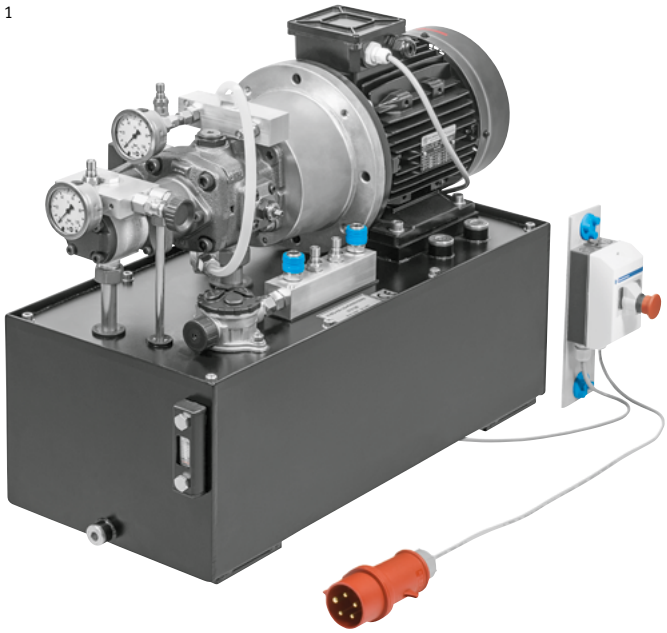

All 230 V power units with grounding plug CEE 7, suitable for: DE, FR, NO, SE, FI, PT, ES, AT, NL, BE, GR, TR, IT, DK, IR, ID.

Note:
For safety reasons, we always supply the hydraulic units without oil filling. Please order the oil separately

Hydraulics
Power Units

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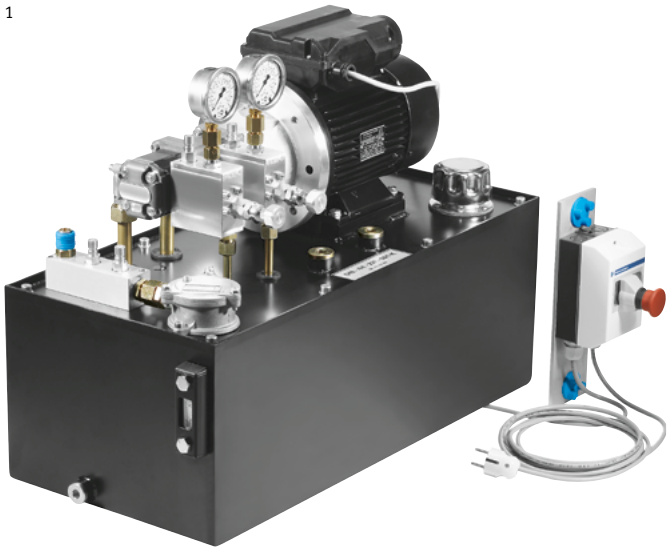

2



1 **Hydraulic power unit with two constant-displacement pumps in combination**
Recommended for achieving higher cylinder speeds and higher engine speeds. Also ideal for creating characteristic curves for valves.

– Can be integrated into mobile Learnline workstation systems
– Pump design: 2x external gear wheel, 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
– Nominal power rating: 1.1 kW
– Tank: 40 l volume, sight glass, temperature display, drain screw
– Tank cap with air filter and return filter
– Low-leakage, self-sealing coupling nipples for P and T
– Connection socket for unpressurized return
– Connecting flange for measuring container return
– Dimensions: 700 x 320 x 550 mm (W x D x H)
– Weight: 65 kg (empty)

Alternating current variant, 230 V/50 Hz
– Power unit with AC motor, single-phase and starter capacitor
– Delivery rate 2x 3.6 l/min

Order no.	**539733**

Three-phase version, 400 V/50 Hz
– Power unit with three-phase motors, three-phase
– Delivery rate 2x 3.7 l/min

Order no.	**541115**

2 **Hydraulic power unit with constant displacement pump**
Ideal for individual hydraulic workstations for all tests with the standard equipment sets TP 500 and TP 600.

– Mounting to Learnline with universal bracket (order no. 539736)
– Mounting to Learntop-S: Direct
– Pump design: External gear with pressure relief valve adjustable from 0 - 6 MPa (0 - 60 bar)
– Operating pressure: 6 MPa (60 bar)
– Motor: Alternating current, single-phase with overload protection, starter 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
– Connection socket for unpressurized return
– Connecting flange for measuring container return
– Dimensions: 580 x 300 x 180 mm (W x D x H)
– Weight: 19 kg (empty)

Alternating current variant
– 220 – 230 V/50 – 60 Hz
– Nominal power: 650 W
– Delivery rate 2.3 - 2.7 l/min

Order no.	**152962**

Alternating current variant
– 120 V/60 Hz
– Nominal power: 450 W
– Delivery rate 2.7 l/min (0.7 gpm)

Order no.	**8065049**

All 230 V power units with grounding 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, we always supply the hydraulic units without oil filling. Please order the oil separately

Hydraulics
Power Units

1 **Wheel set for mounting on the tank**
– Suitable for hydraulic power units with 40 l tank
– 4 guide rollers, 2 with parking brake
– Mounting material included

Order no.	**539734**

2 **Hydraulic fluid (DIN 51524)**
Brand-name hydraulic oil for all Festo hydraulic power units.

HLP22, 10 liters

Order no.	**192215**

HLP22, 20 liters

Order no.	**8201522**

Funnel
Funnel for filling the hydraulic power units.

Order no.	**374038**

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Control and Regulating Electronics

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1/2 **Signal input, electrical**
The unit contains one lit-up push-button (control switch) and three illuminated pushbuttons (momentary-action switches) with connections and two busbars for the power supply.
– Contact set: 1 NO contact, 1 NC contact
– Contact rating: max. 2 A
– Power consumption: Miniature lamp 0.48 W

1 Symbols as per IEC standard
Order no. **162242**

2 Symbols as per NEMA standard
Order no. **8062950**

3 **Indicator unit and distributor, electrical**
The device contains an audible alarm and eight indicator lights with connections and three busbars for the power supply. Plated-through socket pairs per lamp also allow the element to be used as a distributor.
– Power consumption of the audible alarm: 0.04 W
– Power consumption of indicator lights: 1.2 W
– Frequency of the audible signal: 420 Hz
Order no. **162244**

4/5 **Relay, 3-way**
The device contains three relays and two busbars for power supply.
– Contact load: max. 5 A
– Breaking capacity: max. 90 W
– Pickup time: 10 ms
– Drop-off time: 8 ms

4 Symbols as per IEC standard
Order no. **162241**

5 Symbols as per NEMA standard
Order no. **8062958**

6/7 **Time relay, 2-way**
The device contains a relay with dropout delay and a time relay with switch-on delay. Both time relays can be continuously adjusted using a rotary knob on the potentiometer.
– Contact set: 2 NO contacts, 2 NC contacts
– Contact rating: max. 5 A
– Switch-off power: max. 100 W
– Time delay: 0.5 to 10 s, adjustable

6 Symbols as per IEC standard
Order no. **162243**

7 Symbols as per NEMA standard
Order no. **8062960**

Control and Regulating Electronics

1 **Proportional amplifier**
The amplifier is used to control proportional valves. The amplifier is designed in such a way that either two independent solenoids (1 channel) or a valve with two solenoids (2 channels), e.g., a 4/3-way proportional valve, can be controlled. The proportional amplifier therefore works either like two single-channel amplifiers or like a 2-channel amplifier. The inputs are short-circuit-proof and voltage-proof up to 24 V.
– Setpoint values: ±10 V DC, in steps of 100 mV
– Switching signal for internal setpoint values: 15 – 30 V DC
– Solenoid outputs: PWM signal, 24 V, max. 1 A
– Switching signal for release: 15 – 30 V DC
– Base current, step current: 0 – 250 mA, in increments of 1 mA
– Maximum current: 100 mA – 1 A, in steps of 5 mA
– Dither frequency: 100 – 250 Hz, in steps of 1 Hz

Order no. **162255**

2 **Setpoint value card**
The setpoint value card has the following functions:
– Programmable setpoint generation
– Programmable ramp generation
– Cyclic sequence of setpoint values
– and ramps
– Stopwatch
– Number of setpoint values: 8
– Output voltage range: –10 V – +10 V tol. ±5 mV (adjustable in 0.1 V steps)
– Number of ramps: 4
– Ramp times: 0 – 10.0 s/1 V (adjustable in 50 ms/1 V steps)
– Control voltage of the inputs: at least 15 V
– Output rate: 1 kHz
– Stopwatch: input 1, measuring time 0 – 100 h

Order no. **162256**

3 **Comparator**
Positive switching comparator with switching differential. The inputs are short-circuit-proof and voltage-proof up to 24 V. 2 separate inputs (IN A, IN B), each acting on two independent comparators. Adjustable values on each comparator:
– Setpoint voltage (-10 - +10 V), hysteresis (0 - +5 V).
– Input voltage (inputs A and B): -10 – +10 V
– Input resistance (inputs A and B): > 10 kΩ
– Display accuracy: ± 30 mV
– Outputs A and B: Potential-free relay contacts, changeover contact
– Contact load: 24 V DC/2 A and
– 120 V AC/1 A

Order no. **8185562**

4 **PID controller**
PID controller for pneumatic and hydraulic control loops. The closed-loop controller includes the following functions:
– Power supply
– Differential inputs
– Comparators
– Control elements: Proportional element, integral element, differential element
– Manipulated variable offset
– Summation point
– Limiter
– Output

Order no. **162254**

5 **Status controller**
The status controller is used as a controller of control circuits in fluid power positioning. The closed-loop controller includes the following functions:
– Power supply
– Differential inputs
– Comparators
– Control elements: Proportional element, integral element, differential element
– Overall gain
– Manipulated variable offset
– Summation point
– Limiter
– Output

Order no. **162253**

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Control and Regulating Electronics

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1 **Function generator/counter/ stopwatch**
The multifunctional device has an LCD display to show the set operating mode and display the current measured values. The language of the display is switched by simultaneously pressing the START and STOP buttons during switch-on. The function generator provides five operating modes: counting pulses, measuring frequencies, measuring times, outputting square wave signal and outputting DC voltage.
– Operating voltage: 24 V DC
– Voltage of the input signals: +15 – +28 V DC
– Timing range: 0000 - 9999 ms
– Frequency measurement range: 0.1 - 1000 Hz
– Frequency output: 24 V, max. 2 A, 0.01 - 200 Hz
– Pulse width modulated output: 0 - 24 V DC, max. 2 A
– Electrical connection: Sockets for 4 mm safety plug

Order no. **544315**

2 **Operational status display**
For the easy connection and indication of different operating modes and states by flashing and continuous signals of different colors.
Three LED light elements (green, yellow, red), each with a socket for continuous light and flashing light, operating voltage sockets each 6x 24 V DC and 0 V, all connections designed for 4 mm safety plugs, fastening via contact protection with integrated detenting handle strip in the ER mounting frame for electrical connection and control units.

Order no. **567263**

3 **Mushroom-head safety switch**
With dual-circuit switch-off and self-monitoring, can be removed. The two NC contacts open when the mushroom-head safety switch is actuated. A further NO contact is actuated when the safety switch is plugged in and opens when the mushroom-head safety switch is removed or manipulated.
Supply voltage sockets each 6x 24 V DC and 0 V, all connections are designed for 4 mm safety plugs, fastening via contact protection with integrated detenting handle strip in the ER mounting frame for electrical connection and control units.

Order no. **567261**

4 **Safety relay for emergency stop and safety door**
With 4 positively driven relay outputs and 2 input channels, can be used as a safety gate monitor or as emergency stop monitoring.
– Operating modes: start-up test, cross-circuit detection, self-test, automatic start, single-channel, manual start, manual start with monitoring, without cross-circuit detection, dual-channel
– 3 safety contacts (N/O), non-delayed
– 1 auxiliary contact (N/C contact), non-delayed
– 1 semiconductor output
– Operating voltage: 24 V DC
– Operating voltage sockets each 6x 24 V DC and 0 V, all connections designed for 4 mm safety plugs, fastening via contact protection with integrated detenting handle strip in the ER mounting frame for electrical connection and control units.

Order no. **567262**

Control and Regulating Electronics

1 **Terminal block and distributor, electrical**
The device contains six numbered terminal strips and three busbars for the power supply. Like an industrial terminal strip, this can be divided into control, bridge, and field level. Rows of sockets connected with a potential can be bridged with 19 mm safety jumper plugs (not included).

Order no.	**3584313**

2 **Universal connection unit, digital (SysLink)**
The unit connects all 4 mm safety plugs to the 24-pin system plug in accordance with IEEE488 (SysLink). This makes it a universally applicable interface between units with 4 mm connection technology and devices equipped with SysLink plugs in accordance with IEEE488:
– Simple connection to actuators and sensors via 4 mm laboratory plugs with the EasyPort interface unit to 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 plugs (IEEE488)
Status display of the I/O: via LED

Order no.	**162231**

3 **Terminal unit, analog**
In combination with an analog cable (order no. 529141), the unit can also be used as an analog connection unit for the PLC EduTrainer or Easy-Port USB
– Permissible voltage range: 22 – 27 V DC
– 4 analog voltage inputs: range: –10 V – +10 V (maximum 30 V), input resistance: 200 kΩ
– 4 analog current inputs: range: 0 - 20 mA (maximum –4 – +24 mA), input voltage: maximum ±30 V
– 2 analog outputs: Voltage: –10 – +10 V, short-circuit-proof, maximum ±30 V, protected by fuse, current: maximum 20 mA

Order no.	**567232**

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Sensors/Measurement Technology

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1/2/3/4 **Proximity switch**
Proximity switch with protection against reverse polarity, overload, and short circuit.
– Design M12
– Rotatable 210°, detenting every 15°
– Electrical connection via 4 mm safety sockets
– Operating voltage: 10 – 30 V DC
– Output function: N/O (PNP)
– Quick-action mounting system Quick-Fix

1/2 **Proximity switch, optical, M12**
Adjustable switching distance from 70 - 300 mm, with LED

1 Symbols as per IEC standard
Order no. **572744**
2 Symbols as per NEMA standard
Order no. **8062967**

3 **Proximity switch, inductive, M12**
Sensing distance of 0 – 4 mm
Order no. **548643**

4 **Proximity switch, capacitive, M12**
Sensing distance of 0 – 4 mm
Order no. **548651**

5 **Limit switch, electrical**
The microswitch is mechanically actuated by pressing the roller lever with the trip cam of a cylinder, for example. The microswitch can be switched as a normally open, normally closed or changeover contact.
– Contact rating: max. 5 A
– Quick-action mounting system Quick-Fix

Actuation from the left
Order no. **183322**
Actuation from the right
Order no. **183345**

6 **Emergency stop button, electrical**
Emergency stop button consisting of an lit-up mushroom actuator and a set of N/O and N/C contacts installed in a yellow plastic housing.
Emergency stop switch, mushroom actuator version, 1 NO contact and 1 NC contact, connection for 4 mm safety plug with supply busbar, ground busbar.
– Actuator attachment: Mushroom button with detent ring
– Contact set: 1 NO contact, 1 NC contact
– Contact rating: max. 8 A
Order no. **183347**

7 **Proximity switch, electronic**
Magneto-resistive proximity switch, magnetically actuated
– Connection via 4 mm safety sockets
– Switching output N/O (PNP) with switching status indication
– Overload and short-circuit proof, with reverse polarity protection
– Operating voltage: 5 – 30 V DC
– Output current: max. 100 mA
– Switching time (on/off): max. 1 ms
– Mounting system for sensor slot 8
Order no. **2342009**

Sensors/Measurement Technology

1 **Contact tachometer**
For measuring the rotary speed on the hub of a hydraulic or compressed air motor.
– 5 – 99999 rpm (optical measurement)
– 0.5 – 19999 rpm (contact measurement)
– Memory for last, minimum, or maximum measured value

Order no.	**8062148**

2 **GW Instek GDM-533 digital multimeter**
Simple entry-level device for basic training.
– Automatic and manual range selection, measurement of direct and alternating voltage, direct and alternating current, resistance, continuity, flow diode test, capacity and frequency measurement.
– Voltage: 0.01 mV – 1000 V
– Current: 0.1 µA – 20 A
– Resistance: 0.1 Ω – 60 MΩ
– Frequency: 10 Hz – 10 MHz
– Capacity: 0.01 nF – 60 mF
– Measuring circuit category CAT III/1000 V

Scope of delivery
– Measuring leads
– Battery

Order no.	**8217596**

3 **Keysight EDUX52A-EDU Digital Oscilloscope**
Oscilloscope for basic training in electrical engineering with connectivity to a PC to evaluate monitored signals.
– Display: color
– Bandwidth: 50 MHz
– Channels: 2
– Time base: 2.5 ns – 50 s/div
– Sampling rate: 1.0 GS/s
– Resolution: 8 bits
– Interface: USB / LAN
– Additional functions: digital voltmeter, frequency meter

Scope of delivery
– Main power cord,
– 2x N2142A 75 MHz 10:1/1:1 probe
– Documentation

Order no.	**571845**

4 **Function generator**
– Signal types: sine, square, triangle, TTL
– Frequency range: 0.1 Hz – 500 kHz
– Voltage output: DC
– Offset: -15 – +15 V
– Voltage amplitude: 0 – 30 V

Order no.	**8222730**

5 **Cable BNC - 4 mm, 1.6 m long**
Cable with BNC plug and 2 bunch plugs (4 mm). Use in combination with function generator and oscilloscope

Order no.	**8023959**

Cable BNC - BNC, 0.5 m long

Order no.	**158357**

T-piece BNC

Order no.	**159298**

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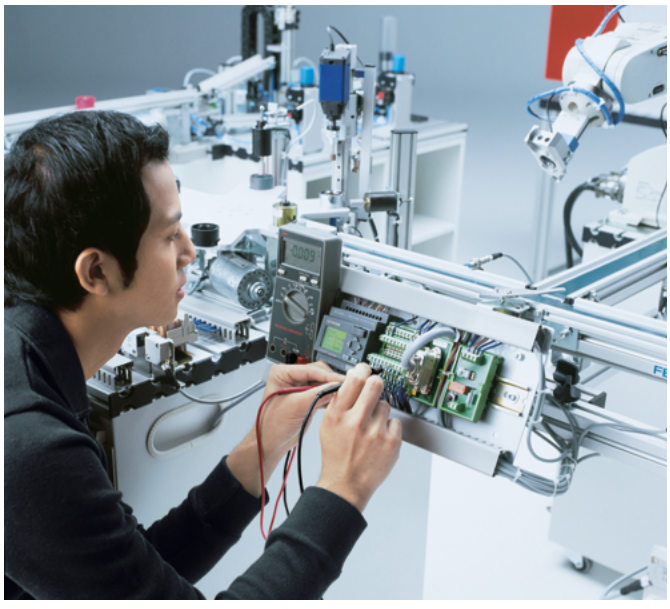

Accessories

Electrical Power Supply

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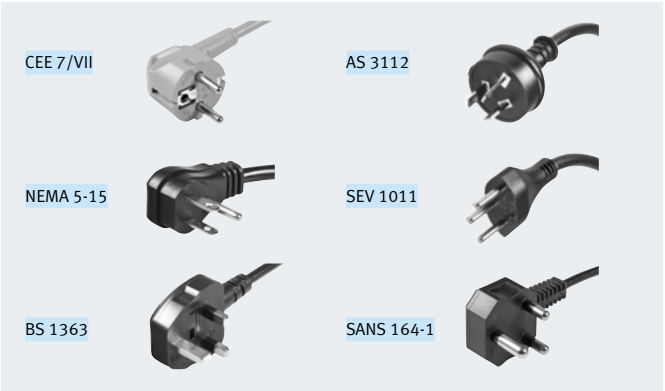

1 **Power supply unit for mounting frame**
– Input voltage:
85 – 265 V AC (47 – 63 Hz)
– Output voltage:
24 V DC, short-circuit-proof
– Output current: maximum 4 A
– Dimensions: 170 x 240 x 92 mm
No IEC power cable
Order no. **8049382**

Plug 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**
Plug as per NEMA 5-15 for US, CA, Central America, BR, CO, EC, KR, TW, TH, PH, JP
Order no. **162411**
Plug as per BS 1363 for GB, IE, MY, SG, UA, HK, AE
Order no. **162412**
Plug as per AS 3112 for AU, NZ, CN, AR
Order no. **162413**
Plug as per SEV 1011 for CH
Order no. **162414**
Plug as per SANS 164-1 for ZA, IN, PT, SG, HK, (GB), (AE)
Order no. **162415**

2 **IEC power cable**
One end designed as an IEC power cable and one end with a country-specific plug.
Plug 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**
Plug as per NEMA 5-15 for US, CA, Central America, BR, CO, EC, KR, TW, TH, PH, JP
Order no. **350362**
Plug as per BS 1363 for GB, IE, MY, SG, UA, HK, AE
Order no. **350363**
Plug as per AS 3112 for AU, NZ, CN, AR
Order no. **350364**
Plug as per SEV 1011 for CH
Order no. **350366**
Plug as per SANS 164-1 for ZA, IN, PT, SG, HK, (GB), (AE)
Order no. **350367**

Accessories

Safety Laboratory Cables

1/2 **4 mm safety laboratory cables**
– Plugs with rigid protective sleeve and axial socket
– Conductor cross section: 1 mm²
– 1000 V CAT II
– Load capacity: 16 A

1 **4 mm safety laboratory cables, 98 pieces, red and blue**
Complete set consisting of 98 safety laboratory cables with 4 mm safety plugs in 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

The safety laboratory cables (47 pcs., black, order no. 8092667), are suitable as the third cable color.

Order no. **8092666**

2 **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 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. **8092668**

3 **Measuring lead holder**
Mobile measuring lead holder with storage box.
– Dimensions (W x H x T): 54 x 135 x 54 mm
– Tray dimensions (W x D): 42 x 51 cm

Order no. **8043430**

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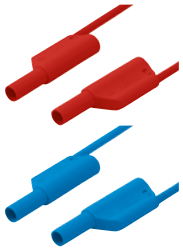

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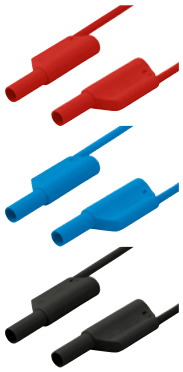

3



Accessories
Organizer

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1/2/3/4/5 **Systainer with T-LOC system**
Stackable and linkable case system made of light gray polymer. The light blue twist lock for opening and linking the Systainer can be operated with one hand. With four slots for labeling or identification in credit card format.

Size I: external 112 x 396 x 296, internal 71 x 389.5 x 275
Order no. **8252760**
Size II: external 187 x 396 x 296, internal 96 x 389.7 x 275.2
Order no. **8252761**
Size III: external 237 x 396 x 296, internal 196 x 389.7 x2 75.2
Order no. **8252762**
Size IV: external 337 x 396 x 296, internal 296 x 389.7x275.2
Order no. **8252763**
Size V: external 437 x 396 x 296, internal 394 x 389.7x275.2
Order no. **8252764**

Dimensions H x W x D in mm each.

6 **Dolly truck for Systainer**
Dolly truck for transporting T-LOC and Classic-Line Systainers sizes I to V. Four swivel castors, two of which have parking brakes.
Order no. **549789**

7 **Storage system for A4 EduTrainer**
Case with slotted foam sheets for holding A4 EduTrainer units and permanently attached cover with a stop in the open position. The enclosed separator plate can be used to partition off an area for holding measuring devices and cables, while also providing convenient access to an EduTrainer with a width of 133 mm. The exterior consists of grained laminate with edges protected by metal profiles. The case features a sturdy folding handle, rubber feet and two buckles that can be locked with padlocks.

Provides space for up to three A4 EduTrainer units with a width of up to 399 mm and additional accessories.
Order no. **8047571**

Accessories
Organizer

Systainer/drawer unit inserts
Didactic components need to be clearly and securely stored. Simply clamp two handles to the narrow sides of an insert of your choice and then stack the inserts in the Systainer. By the way, two large and one small insert fill exactly one drawer of a Learnline container.

1 **Systainer/drawer unit insert A**
Dimensions (W x T): 351 x 172 mm.
For Systainer sizes 1 – 4
Order no. **8201536**

2 **Systainer/drawer unit insert B**
Dimensions (W x T): 351 x 264 mm.
For Systainer sizes 1 – 4
Order no. **8201535**

3 **Systainer/drawer unit insert C**
Dimensions (W x T): 351 x 264 mm.
For Systainer sizes 1 – 4
Order no. **8201537**

4 **Systainer/drawer unit insert D**
Dimensions (W x T): 351 x 264 mm.
For Systainer sizes 1 – 4
Order no. **8201534**

5 **Systainer/drawer unit insert E**
Dimensions (W x T): 351 x 264 mm.
For Systainer sizes 1 – 5
Order no. **8201540**

6 **Systainer/drawer unit insert F**
Dimensions (W x T): 351 x 264 mm.
For Systainer sizes 1 – 5.
Order no. **8201541**

7 **Systainer/drawer unit insert G**
Dimensions (W x T): 351 x 264 mm.
For Systainer sizes 1 – 5
Order no. **8201538**

8 **Systainer/drawer unit insert H**
Dimensions (W x T): 351 x 264 mm.
For Systainer sizes 1 – 5
Order no. **8201539**

9 **Systainer/drawer unit insert I**
Dimensions (W x T): 351 x 264 mm.
For Systainer sizes 1 – 5
Order no. **8201542**

10 **Systainer/drawer unit insert J**
Dimensions (W x T): 351 x 264 mm.
For Systainer sizes 1 – 5.
Order no. **8201543**

11 **Systainer/drawer unit insert K**
Dimensions (W x T): 351 x 264 mm.
For Systainer sizes 1 – 5.
Order no. **8201544**

12 **Systainer/drawer unit insert L**
Dimensions (W x T): 351 x 172 mm.
For Systainer sizes 1 – 4
Order no. **8201545**

13/14/15 **Handles for Systainer/drawer unit inserts**
The handles are available in three different heights, suitable for Systainer sizes 2 – 5:
– Handle 80: height 80 mm
– Handle 100: height 100 mm
– Handle 150: height 150 mm
When stacking the inserts in the Systainer, the height of the handle defines the distance between the stacked inserts. The handles can be used for all Systainer/drawer unit inserts. Two handles are required per insert.

13 Handle 80	**8201531**
14 Handle 100	**8201532**
15 Handle 150	**8201533**

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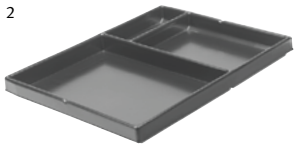

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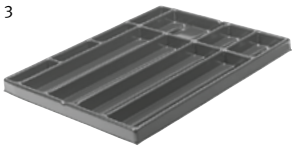

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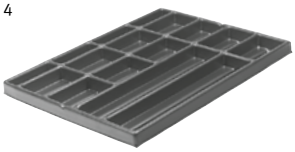

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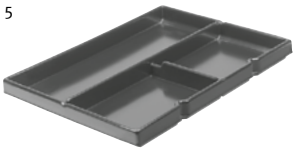

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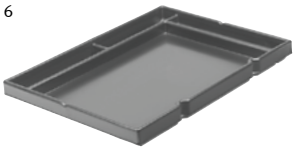

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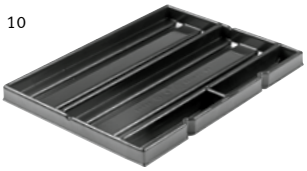

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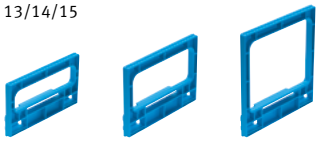


Digital Learning





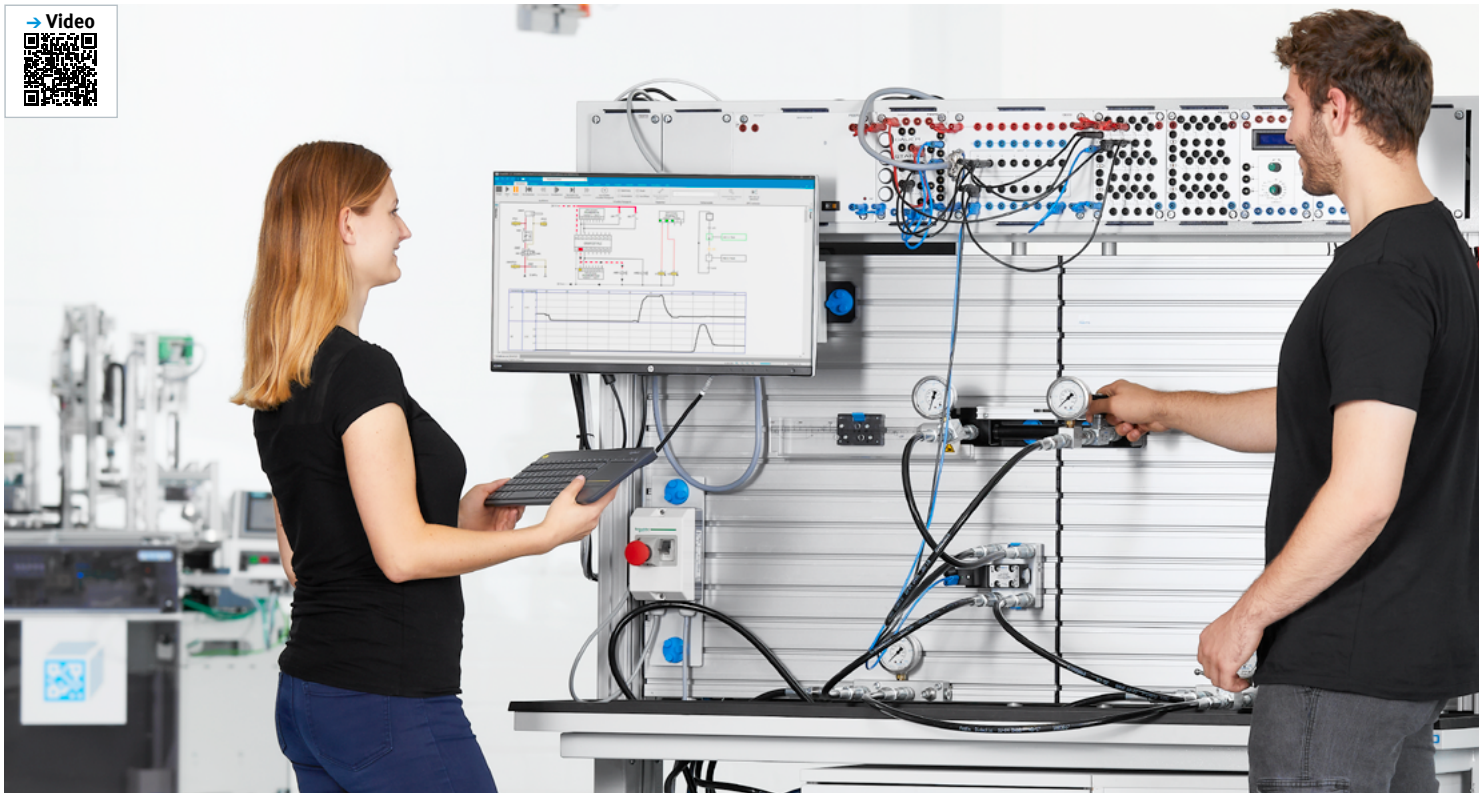
Digital Learning
Festo Learning Experience (Festo LX) 164
FluidSIM 168

Further Learning Materials
Poster Sets 170

Festo Learning Experience (Festo LX)

The Digital Learning Portal for Customized Learning Experiences

→ Video



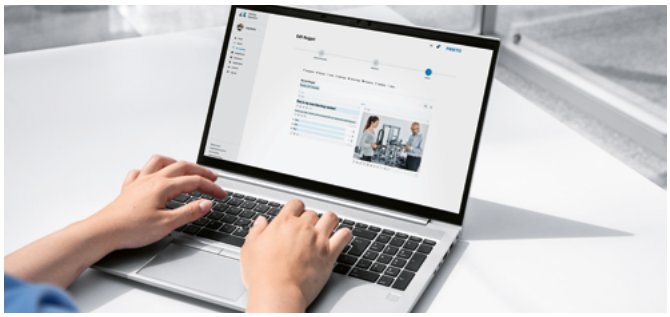
What makes Festo LX unique
With Festo LX, we have created a digital learning portal that offers a high degree of flexibility, personalization and hardware integration.

Included in Festo LX is an extensive library of course content. Different learning formats are combined to make learning as varied and interactive as possible. The existing content is created on the basis of individual learning nuggets and can thus be quickly and easily adapted to the specific needs of the learners.

Combining theory and practice is easy with Festo LX. Matching the connected learning systems, Festo LX shows suitable courses to perform practical exercises.

Individual learning with Festo LX
Festo LX offers a high degree of individualization so that learners are taught exactly the knowledge they need.

Festo LX follows the so-called nugget concept with its courses. Nuggets are small, self-contained learning contents that offer the opportunity to learn in a targeted and effective manner. Nuggets are usually designed with a combination of text, images, videos, animations, quizzes, links and other interactive elements. Several nuggets can be combined to form a specific course and thus convey content on a specific topic.



LX Creator
Thanks to our nugget concept, existing courses and learning paths can be updated quickly and easily. With the LX Creator, educators can also develop their own content using an intuitive tool supported by AI for generating texts and quizzes. The Creator ensures the same look and feel as Festo Didactic content, giving learners a consistent experience while making content creation simpler for teachers.

Learning paths
Learning paths are made up of a combination of different courses on a specific topic or professional field. They provide structures and recommendation for the ideal order in which courses should be completed. Our learning paths are based on our didactic expertise as well as on national occupational profiles and curriculum frameworks. The learning paths can be revised and created in the same way as courses using the LX Creator.



Festo LX
The advantages at a glance

- Individual and goal-oriented design of the lessons
- Flexible to use
- Supports many different teaching and learning scenarios
  - traditional or flipped classroom
  - distance learning
  - self-paced learning
  - and more
- Existing course materials can be linked with the appropriate learning systems from Festo Didactic in order to combine theory with practice and ensure a steep earning curve



- The learning content on Festo LX can be personalized using the online authoring tool LX Creator in order to meet the needs of teachers and students
- Existing learning content can be enhanced with own materials

→ **Festo LX Course Catalog (PDF)**



Course content in Festo LX
Festo LX offers a wide range of different learning contents for many areas of technical education and training. The Festo LX learning library includes more than 600 courses on factory automation, fluid power, Industrial Internet of Things (IIoT) and Industry 4.0, as well as electrical engineering, process automation, renewable energy and STEM. The learning content available on Festo LX is constantly revised and expanded to meet educational needs.



LX Tutor: an AI-based companion
The LX Tutor enhances the learning and teaching experience by supporting users through interactive, educational conversations. It answers questions related to Festo LX learning content with referenced sources and offers proactive guidance when learners struggle—for example, after incorrect quiz answers, extended learning times, or repeated access to the same material. The LX Tutor can be enabled or disabled at any time and is automatically deactivated during evaluations.



Partnerships
Together with partners, we are constantly developing and improving the content available on Festo LX. In this way, we ensure that the learning content on Festo LX meets the requirements of the industry and that learners are trained in the necessary skills.



Easy access
Festo LX is a cloud-based learning portal. This eliminates the need for local installations and gives you access to the latest updates on functionalities and learning content at all times. Festo LX is used via license packages that are tailored to the number of users and the period of use.

Festo Learning Experience (Festo LX)

Find out more about our learning formats



Festo LX provides a wide variety of learning materials covering many areas of technical education and training. These areas include factory automation, fluid technology, the Industrial Internet of Things (IIoT), Industry 4.0, electrical engineering, process automation, renewable energies, STEM, and many other technical fields. Additionally, we provide technology-independent, comprehensive learning content on lean management, project management, and soft skill development.

To make lessons as effective and varied as possible, it is necessary to use different learning formats. Festo LX offers a wide range of options for presenting and conveying learning content.

eLearning courses
Our eLearning courses are interactively designed learning content, usually with a storytelling approach and with a narrator guiding through the course. These courses are particularly suitable as an introduction to new topics and provide a high-level overview. Best of all, all you need is a tablet, laptop, or smartphone with an Internet connection to complete the courses.

eLab courses
Our eLab courses offer a wide range of hardware-related learning content, taught either through the use of Festo Didactic equipment or simulation software. Our associated learning systems are required to complete the courses. Our eLab courses are designed to test previously learned theoretical knowledge with practical tasks.

eTheory courses
Our eTheory courses offer a wide range of hardware-independent learning content on technical topics. Compared to eLearning courses, they generally impart broader knowledge.

Simulations
Our simulations guide learners to perform hands-on, safe experiments that have no impact on real-world processes. The simulations provide a cost-effective learning extension, saving the need to purchase additional learning equipment.

A **Festo LX** subscription gives you full access to our extensive library of technical training content, as well as all standard functionalities of the digital portal. You can modify existing courses and learning paths or build your own custom courses and paths, and then manage the entire learning process – including assignment, delivery, and tracking – directly within the Festo LX environment.

Festo LX for Education

1-year subscription	**8219584**
3-year subscription	**8219585**
5-year subscription	**8219586**

Note: Unlimited number of users with 100 concurrent users.

Festo LX for Industry

1-year subscription (single user)	**8219587**
3-year subscription (single user)	**8246988**
5-year subscription (single user)	**8246989**

Note: The number of users can be tailored to customer requirements.

A **Festo LX Premium** subscription seamlessly and securely connects Festo LX to your learning management system (LMS). Through this LMS integration, you can use the Festo course library, modify content or build your own courses in Festo LX, and then make them available in your LMS for assignment/delivery and tracking – without disrupting your usual LMS workflows.

Festo LX for Education Premium **New**

1-year subscription, 100 users	**8251501**
1-year subscription, 500 users	**8251502**
3-year subscription, 100 users	**8251503**
3-year subscription, 500 users	**8251504**
5-year subscription, 100 users	**8251505**
5-year subscription, 500 users	**8251506**

Festo LX for Industry Premium **New**

1-year subscription (single user)	**8251507**
3-year subscription (single user)	**8251508**
5-year subscription (single user)	**8251509**

Expansion option for all subscriptions

Single Sign-On (SSO) Festo LX	**8157218**

Note: Please clarify the technical requirements with your IT before placing an order for Festo LX SSO. Establishing SSO for Festo LX is a one-time service fee and does not need to be ordered again when the subscription for Festo LX will be extended.



Learning videos
In our learning videos, experts present complex topics in a simple way. In the videos, current topics within the scope of technical training are explained in an easy-to-understand and practical manner, which enables fast and effective learning.



Evaluations
Thanks to the integrated evaluations in Festo LX, knowledge tests can be automatically carried out and evaluated.



User guides
Our user guides serve as digital manuals that support getting started with a new learning system or software in an interactive and engaging way.



eBooks
We make courses that are not yet digitally optimized available as eBooks on Festo LX. We are continuously working on new interactive content.

Campus licenses are available for offline usage.
PDF or printable versions are available for selected learning materials, catering to those who prefer offline solutions or need additional resources. Campus licenses allow schools and small companies to use the licensed educational material at a single location, providing users with modification and reproduction rights as outlined in the license agreement. Delivery options (downloads, printed documents, USB keys...) and formats, as well as language variations, depend on the specific educational material.

FluidSIM

Design. Simulate. Learn.





For more than 25 years, FluidSIM has been the world's leading simulation software for creating and simulating circuit diagrams in pneumatics, hydraulics, and electrical engineering.

FluidSIM enables valuable technical skills to be acquired by designing circuits, bringing them to life through simulation, and optimizing them through interaction. The simulation of control systems and processes has long been an industrial standard that ensures errors are prevented, and efficiency and quality are increased.

Objectives
FluidSIM provides a practical way for students to develop their skills in automation technology and to master complex tasks.

The learning objectives of FluidSIM include:
– Creating circuit diagrams
– Identifying and preventing errors
– Optimizing solution circuit diagrams through interactive simulations
– Understanding how solutions are developed
– Observing effects through real-time simulations

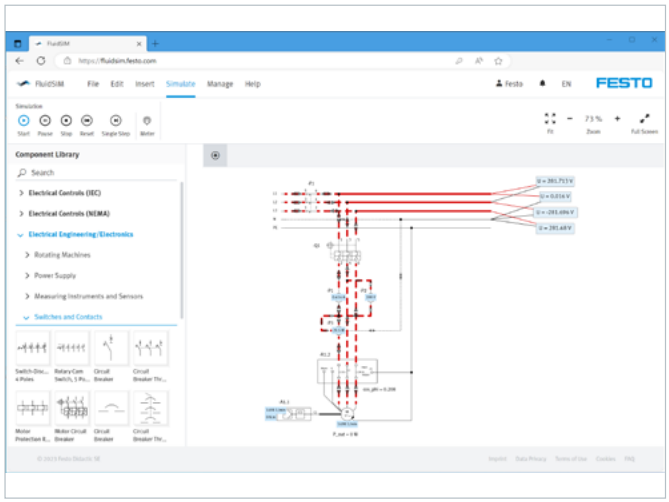
Component library
FluidSIM also has component libraries for pneumatics, hydraulics, and electrical engineering that can be used either separately or in combination. The component libraries include hundreds of pneumatic, hydraulic, electrotechnical, electric, and digital components, and are constantly expanded and revised.

GRAFCET
GRAFCET diagrams can be created and included in simulations in FluidSIM. These simulations comprise:
– GrafEdit: Standard-compliant creation of GRAFCETs
– GrafView: Visualization of the control sequence mapped as GRAFCET
– GrafControl: Controlling the process with GRAFCET, including fault simulation and process monitoring
– GrafPLC: Manufacturer-independent control of all fluid and electrical engineering systems

Virtual and real measuring devices
FluidSIM offers both real and virtual measuring devices that can be integrated into circuits. Before the simulation, real measuring devices are installed, while virtual measuring devices are used during or before the simulation to display the simulated values of the circuit. In contrast to real measuring devices, virtual measuring devices do not influence the circuits. They therefore show the pure values of the circuit simulated by FluidSIM. Virtual measuring devices can be used in electrical as well as pneumatic and hydraulic circuits.

Fault models and diagnostics
FluidSIM has an innovative diagnostic concept, which enables the readily available fault models for various components to be compiled. Before a simulation, a specific error configuration can be selected; this then has an impact on the subsequent simulation. During this simulation, defective components are identified with the help of virtual measuring devices and then virtually repaired.

Lesson preparation and learning materials
With the expert mode of FluidSIM, profiles can be created and lessons can be organized and then assigned to students. The profiles enable the functions, components, and error models to be narrowed down, for example so that students only deal with the functions and tasks that are relevant to them. Multimedia training content is also available on FluidSIM so that variety and interest can be added to the lessons.



FluidSIM at a glance

- Convenient creation of circuit diagrams and their interactive simulation
- Content tailored to Festo Didactic learning systems
- Various usage options: web, Windows, and via the Festo LX digital learning portal
- Can be used online and offline
- Fast learning preparation and individual learning
- Learn what effects changes in a technical set-up have and observe the immediate consequences by running real-time simulations
- Extensive library of pneumatic, hydraulic, control, electronic and digital components
- Virtual and real measuring devices
- Fault models for developing skills in troubleshooting and preventing errors

Interfaces to practical applications
With FluidSIM, students put the knowledge they have learned into practice straight away. Signals are transmitted either via the connected hardware or via interfaces from other programs. All parameters are identical to those of the training packages from Festo Didactic and additionally, they can be fully adapted to the characteristics of other components. The EasyPort hardware enables FluidSIM to be used both as a controller for real systems and as a replacement for them. The industry standard OPC-UA is also supported, bringing FluidSIM even closer to industrial applications.

Integration in Festo LX
By integrating FluidSIM in Festo LX, simulation tasks can be created directly in Festo LX by the tutors and then processed and simulated by the students. Users no longer have to switch between the two programs.

User versions
FluidSIM can be accessed in different ways. Depending on the license, users can choose between the Windows version, the web version, or they can opt to integrate FluidSIM into our digital learning portal Festo LX.

Web version
The web version of FluidSIM is a device-independent user application. It can be accessed anytime, anywhere, and from any device (e.g., iPad). The web version includes approximately 80% of the functionality of the Windows version, covering all the most important and frequently used features. It is continuously developed and enhanced, with additional functions available exclusively on the web.

Windows version
The Windows version includes all the functionalities and content of FluidSIM. Please note that this version can only be run on devices with a Windows operating system. This version can also be used offline.

Our licensing options
FluidSIM 365 and FluidSIM 6 are the two license versions available for FluidSIM.

The FluidSIM 365 license version gives users access to the web and Windows versions, as well as the FluidSIM functions within Festo LX. All updates and upgrades are included in the FluidSIM 365 license.

A pure FluidSIM 6 license includes all the updates for version 6. Upgrades to a higher version are not included, nor is the use of the web version and the functions of FluidSIM within Festo LX possible.

The licenses for all the versions provide users with maximum flexibility. As a result, some of the licenses can be used for the web version, some for the Windows version, and the rest for using FluidSIM in Festo LX. We have applied the floating principle: this means that as soon as a user no longer actively uses a license, it is available for the next user in the organization.

FluidSIM 365 – 1 year

Pneumatics	**8198195**
Hydraulics	**8198196**
Electrical Engineering	**8198197**

FluidSIM 365 – 3 years

Pneumatics	**8198198**
Hydraulics	**8198199**
Electrical Engineering	**8198200**

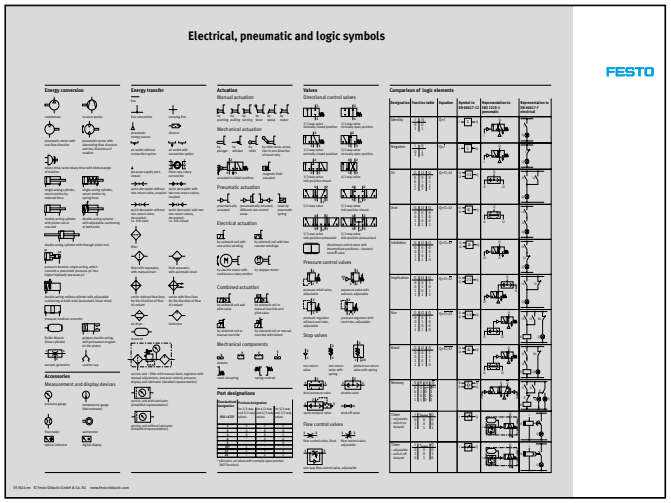
FluidSIM 365 – 5 years

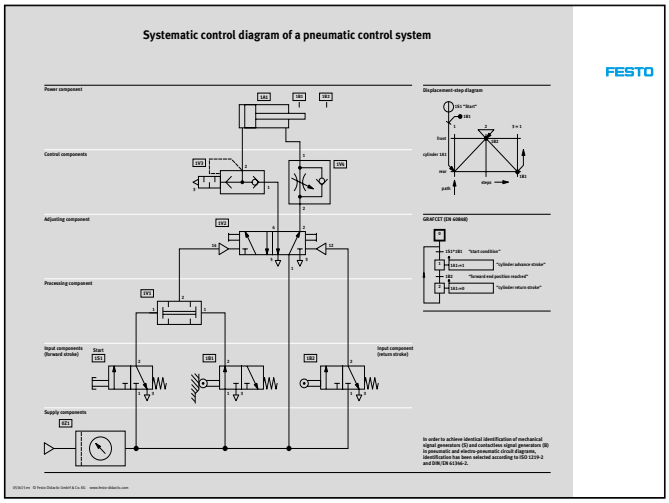
Pneumatics	**8198201**
Hydraulics	**8198202**
Electrical Engineering	**8198203**

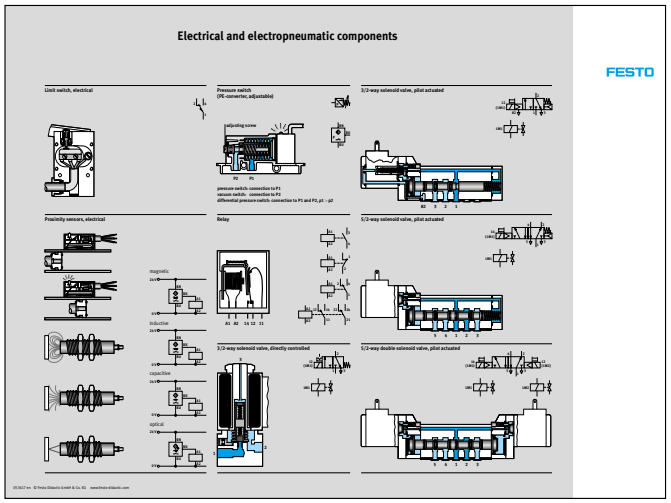
FluidSIM 6

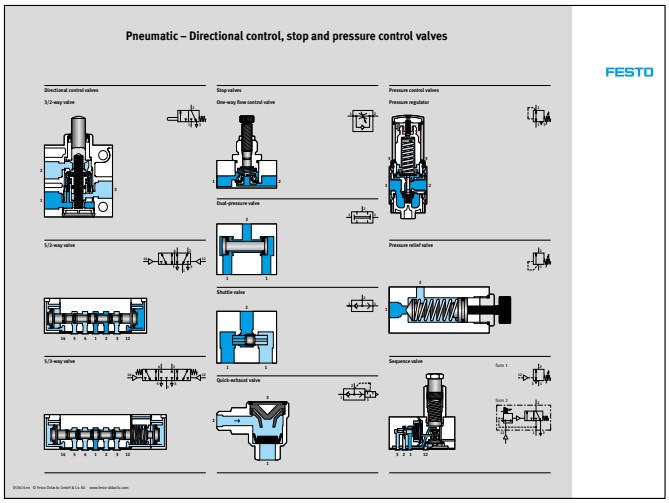
Pneumatics	**8198189**
Hydraulics	**8198190**
Electrical Engineering	**8198191**

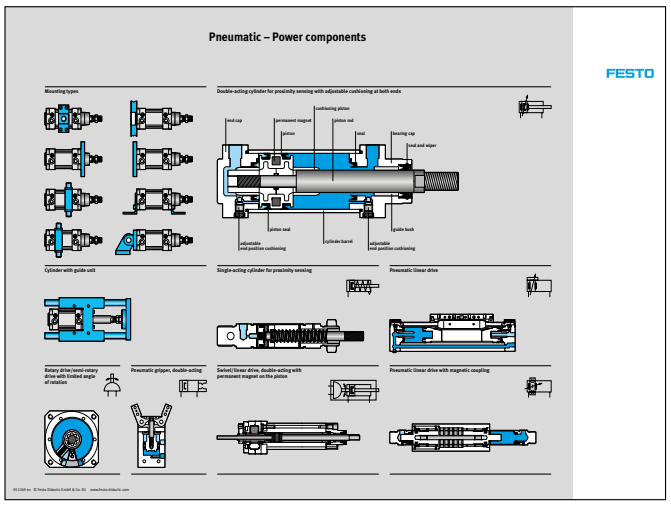
Pneumatics
Set of Posters











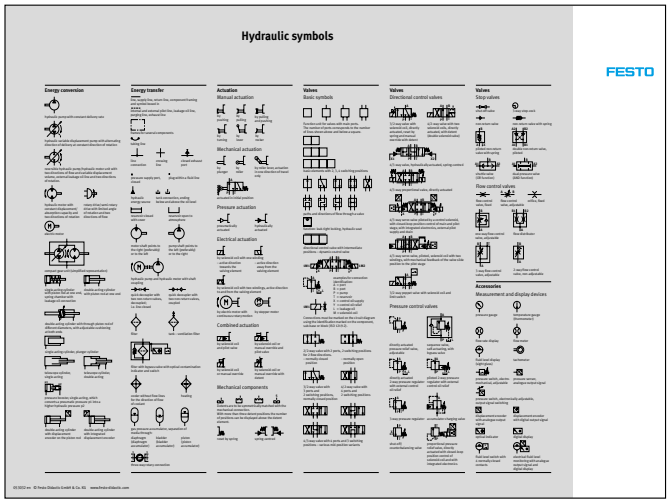
Everything that you need to know: 5 posters on pneumatics

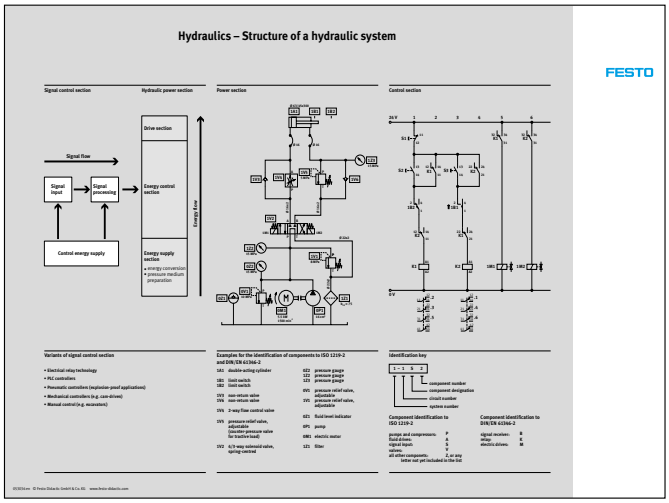
The updated edition of the popular DIN A1 posters is also supplied rolled up and quickly provides a comprehensive overview. All symbols and designations comply with the current ISO 1219-1 and EN 81346-2 standards.

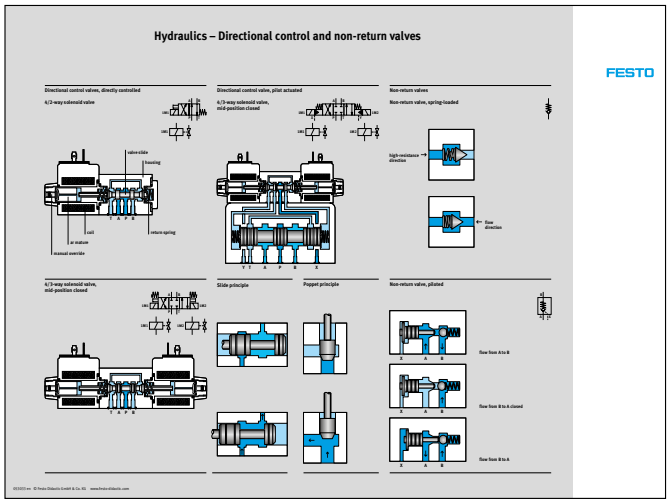
Poster topics:
- Electrical, pneumatic, and logic symbols
- Circuit diagram systematics of a pneumatic control
- Electric and electropneumatic elements
- Pneumatics–directional control valves, shut-off valves, and pressure regulators
- Pneumatics–power components

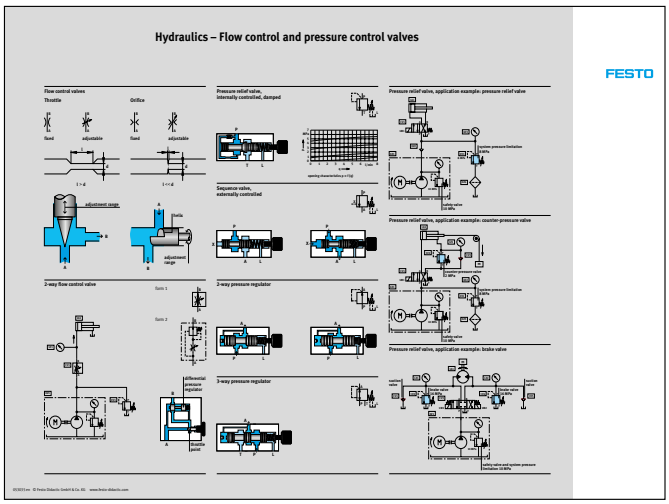
de	**193129**
en	**551015**

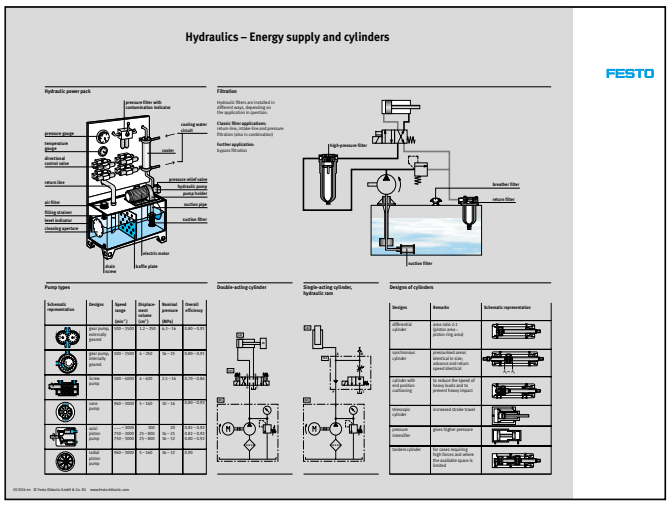
Hydraulics
Set of Posters











Everything you need to know:
5 posters on hydraulics

The updated edition of the popular DIN A1 posters is also supplied rolled up and quickly provides a comprehensive overview. All symbols and designations comply with the current ISO 1219-1 and EN 81346-2 standards.

Poster topics:
- Hydraulic symbols
- Hydraulics–Structure of a hydraulic system
- Hydraulics–Directional control and non-return valves
- Hydraulics–Flow and pressure regulators
- Hydraulics–Power supply and cylinder

de	**196948**
en	**551012**

Space for Your Ideas

Space for Your Ideas

Services





Services 176

Services

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Teacher certification training help you to get the best possible use out of your new learning system. Our qualified trainers present the equipment and provide the training material, and also explain how to carry out the exercises and integrate them quickly into your existing training programs. These training sessions can be conducted on your premises, at a Festo location, or via video conference.

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Customized service contracts give you peace of mind as our team takes care of all the equipment. Available services include on-site hardware maintenance and calibration, warranty extension and repairs, regular train-the-trainer sessions, and much more.

Personal advice
We will be happy to provide you with advice about the concept and planning on site.

For more information, please get in touch with your Festo contact person or write to: did@festo.com

Some learning solutions included in this product guide do not have a CE mark and cannot be ordered for delivery to Europe.

If you are located in a country where this marking is required, please contact your Festo sales representative before placing an order.

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