LUCAS-NÜLLE

MACHINERY AND SYSTEMS ENGINEERING

Developing Practice-oriented and Project-based Skills and Expertise

3rd Edition

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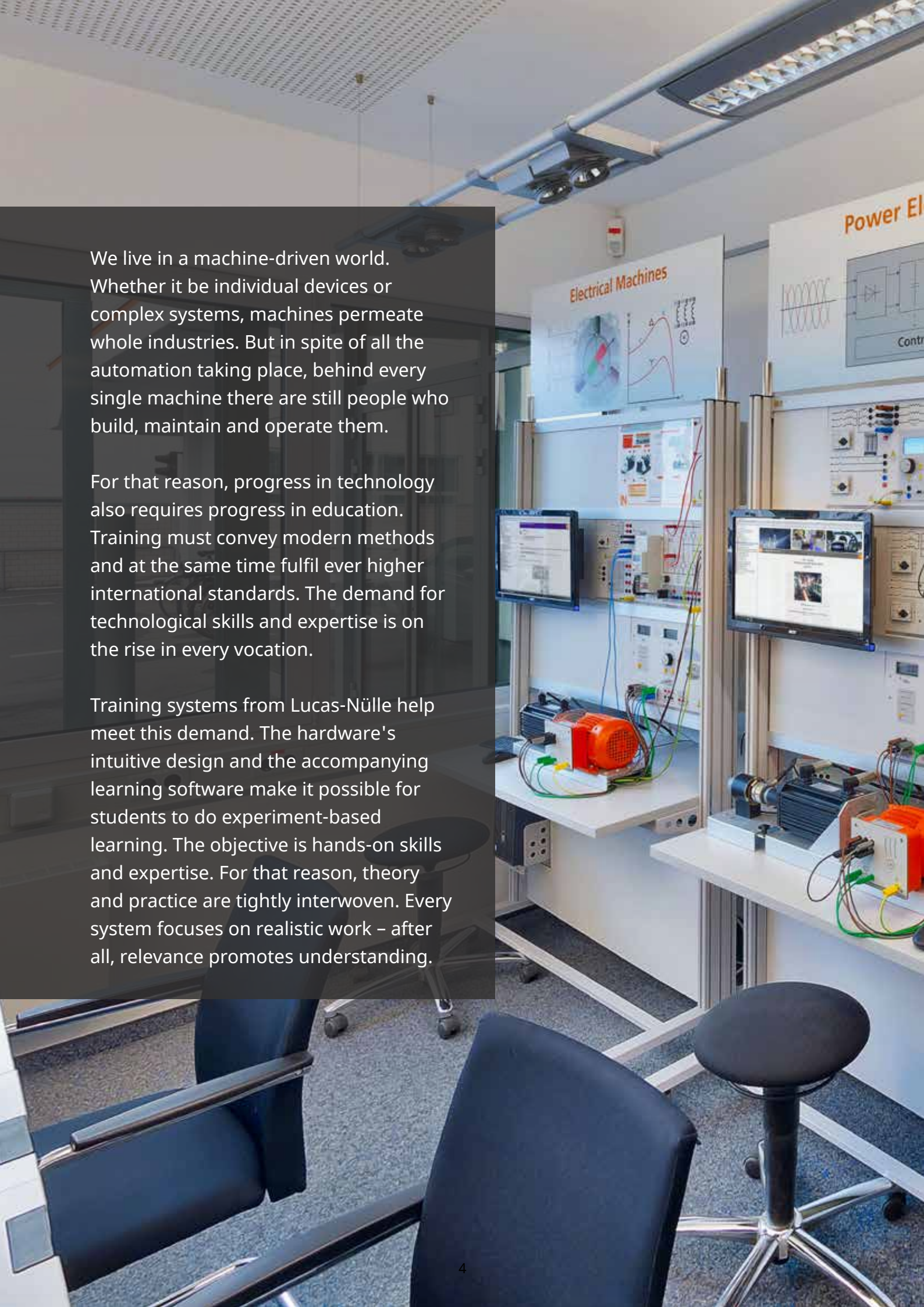


We live in a machine-driven world. Whether it be individual devices or complex systems, machines permeate whole industries. But in spite of all the automation taking place, behind every single machine there are still people who build, maintain and operate them.

For that reason, progress in technology also requires progress in education. Training must convey modern methods and at the same time fulfil ever higher international standards. The demand for technological skills and expertise is on the rise in every vocation.

Training systems from Lucas-Nülle help meet this demand. The hardware's intuitive design and the accompanying learning software make it possible for students to do experiment-based learning. The objective is hands-on skills and expertise. For that reason, theory and practice are tightly interwoven. Every system focuses on realistic work – after all, relevance promotes understanding.

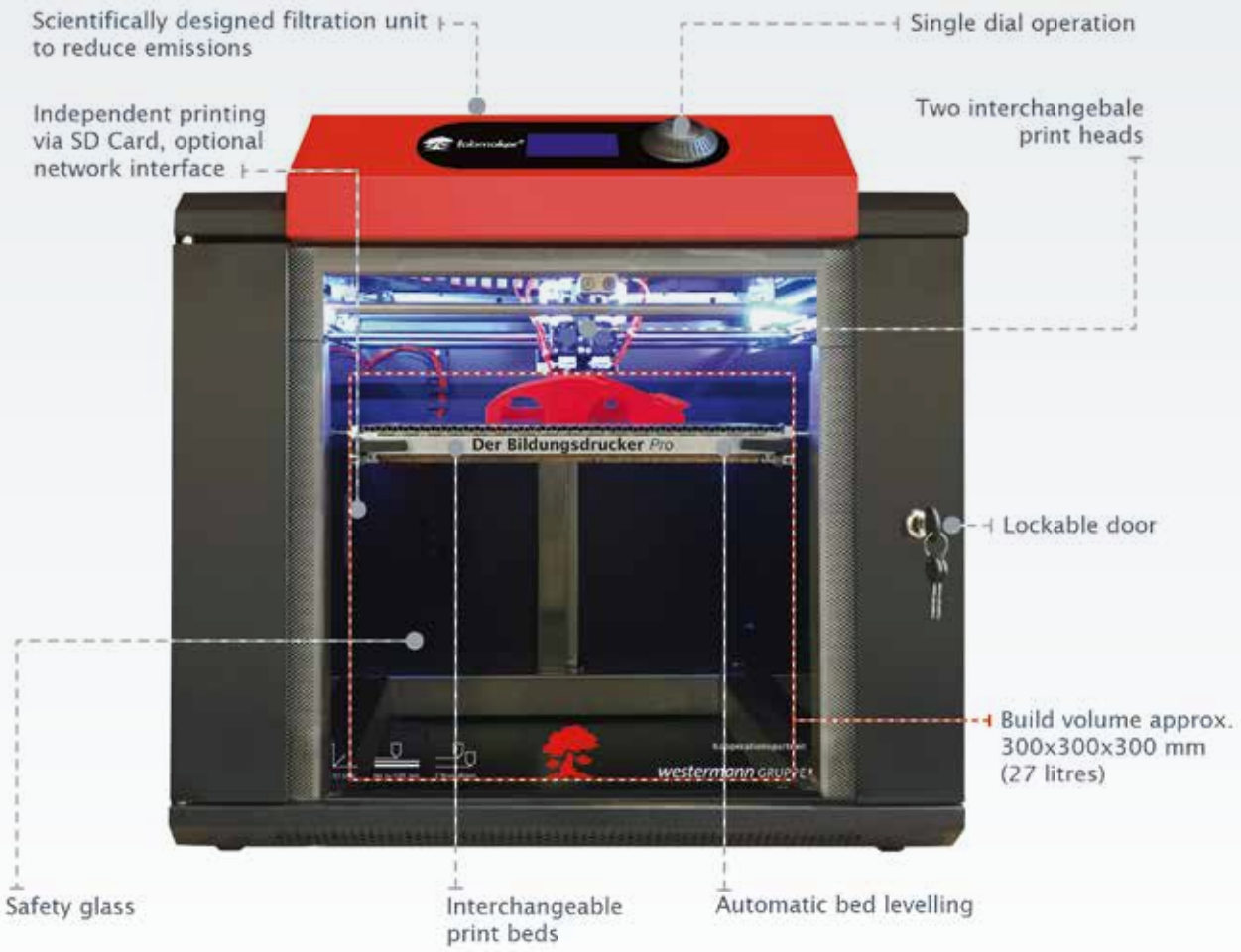

ectronics
MATLAB
SIMULINK
Drive shaft mounting

ADDITIVE MANUFACTURING

In modern industrial production, additive manufacturing is already standard procedure. The reason for this is the increasing variety of products and their ever shorter life cycles. This means when it comes to prototypes, custom manufacturing or small batches, there is tremendous potential for an industrial revolution right out of the printer.

In cooperation with the company fabmaker GmbH, Lucas-Nülle now offers an innovative, modular teach & learn concept including educationally designed training material on 3D printing applications.

3D EDUCATION PRINTER PRO



The 3D Education Printer Pro (Bildungsdrucker®) stands out thanks to its bigger-than-average printing chamber and its patented interchangeable printing head with two printing nozzles. Using this printer, a multitude of objects can easily be realized, in a variety of colours or materials

Benefits

- The particularly large print volumes are made possible thanks to the simultaneous printing of several objects
- The two printing nozzles permit a high degree of material variety and different colours and material combinations
- Excellent quality for models thanks to a very thin coating (up to 0.02 mm)
- No risk of burns or crushing and no toxic fumes within the immediate work area
- Automated set-up and printing process for maximum comfort so more time can be devoted to learning and projects

Digital training environment

In conjunction with an Interactive Lab Assistant (ILA) course, the educational printer is used to teach skills and expertise in additive manufacturing.

The content of the ILA course assists:

- in understanding the importance of Industry 4.0 for the world of work
- in fully grasping the implications of digitalization "from the idea all the way to the end product"
- in becoming familiar with networked production based on the example of 3D printing
- in teaching skills and expertise for digital technologies

Training contents

- Becoming familiar with manufacturing procedures and methods
- Properties of filaments
- Understanding entire process chains
- Areas for 3D printing applications
- The slicer as an important component in a process chain
- Detecting printing errors
- Creating a CAD model
- Writing G code
- Printing components

3D EDUCATION PRINTER SMART

The 3D Education Printer Smart (Bildungsdrucker®) offers a compact and effective solution for 3D printing in an everyday educational environment. Its operational safety makes it far superior to its competitors on the market.

Benefits

- Thanks to its size and relatively light weight, the printer takes up very little space and is easy to reposition
- Fully automatic printing process and semi-automatic set-up procedure make the printer very easy to operate for laypersons
- Producing models of excellent quality thanks to a very thin coating (up to 0.06 mm)
- No risk of burns or crushing and no toxic fumes within the immediate work area

Digital training environment

In conjunction with an Interactive Lab Assistant (ILA) course, the educational printer is used to teach skills and expertise in additive manufacturing.

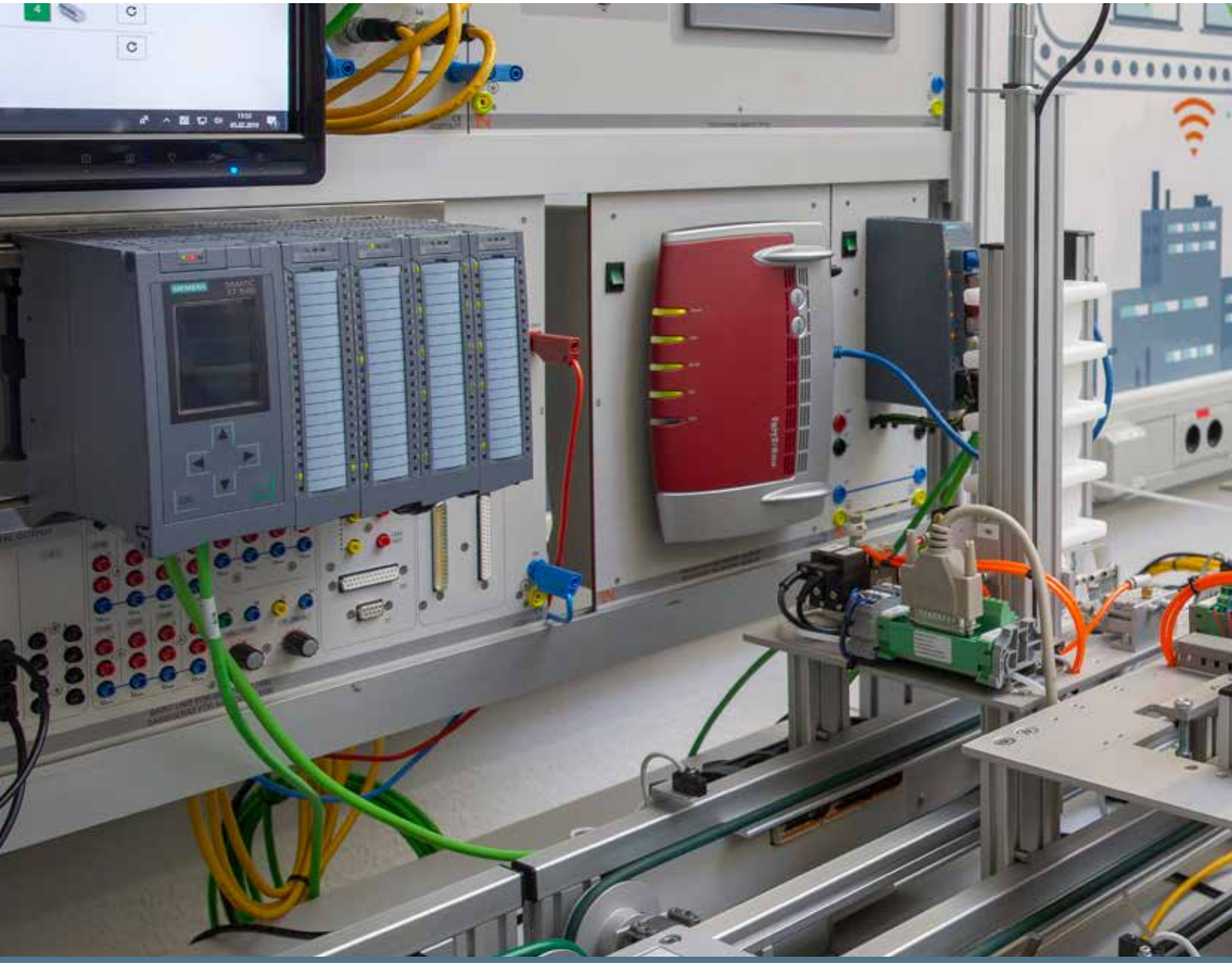
The content of the ILA course assists:

- in understanding the importance of Industry 4.0 for the world of work
- In fully grasping the implications of digitalization "from the idea all the way to the end product"
- in becoming familiar with networked production based on the 3D printing example
- in teaching skills and expertise for digital technologies

Training contents

- Becoming familiar with additive manufacturing methods
- Properties of filaments
- Understanding entire process chains
- Areas for 3D printing applications
- The slicer as an important component in a process chain
- Detecting printing errors
- Creating a CAD model
- Writing G code
- Printing components

ERP-LAB – ESPECIALLY FOR TRAINING PURPOSES INCLUDING THE "ADDITIVE MANUFACTURING" WORKSTATION

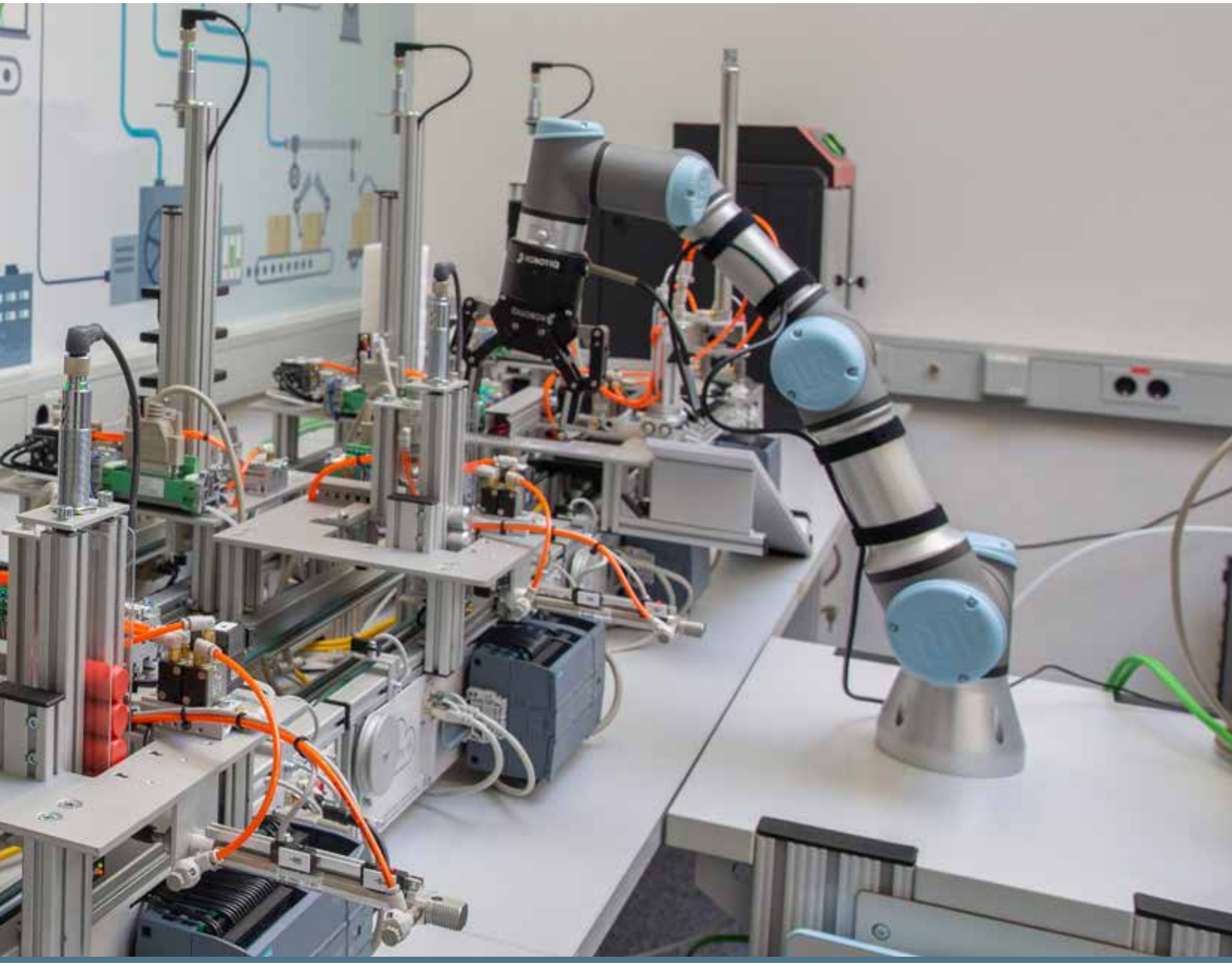


Automation technology never comes to a standstill

The 3D printer is integrated into the ERP system as well as into the webshop as a new component in the Industry 4.0 system (smart factory). All you need is a browser to order from any mobile device. While shopping, the customer directly sees how much is in the basket. The prices for individual products are also administered from the ERP system. Production and material costs are constantly monitored and assessed thanks to the unit prices stored in the system. Data export is also possible.

Benefits

- Monitoring the entire internal process of production
- SCADA function: malfunction alarms and problem localization integrated into production process
- Monitoring warehouse inventory: signalling whether orders can be filled
- Automated order procedure possible when inventory is too low

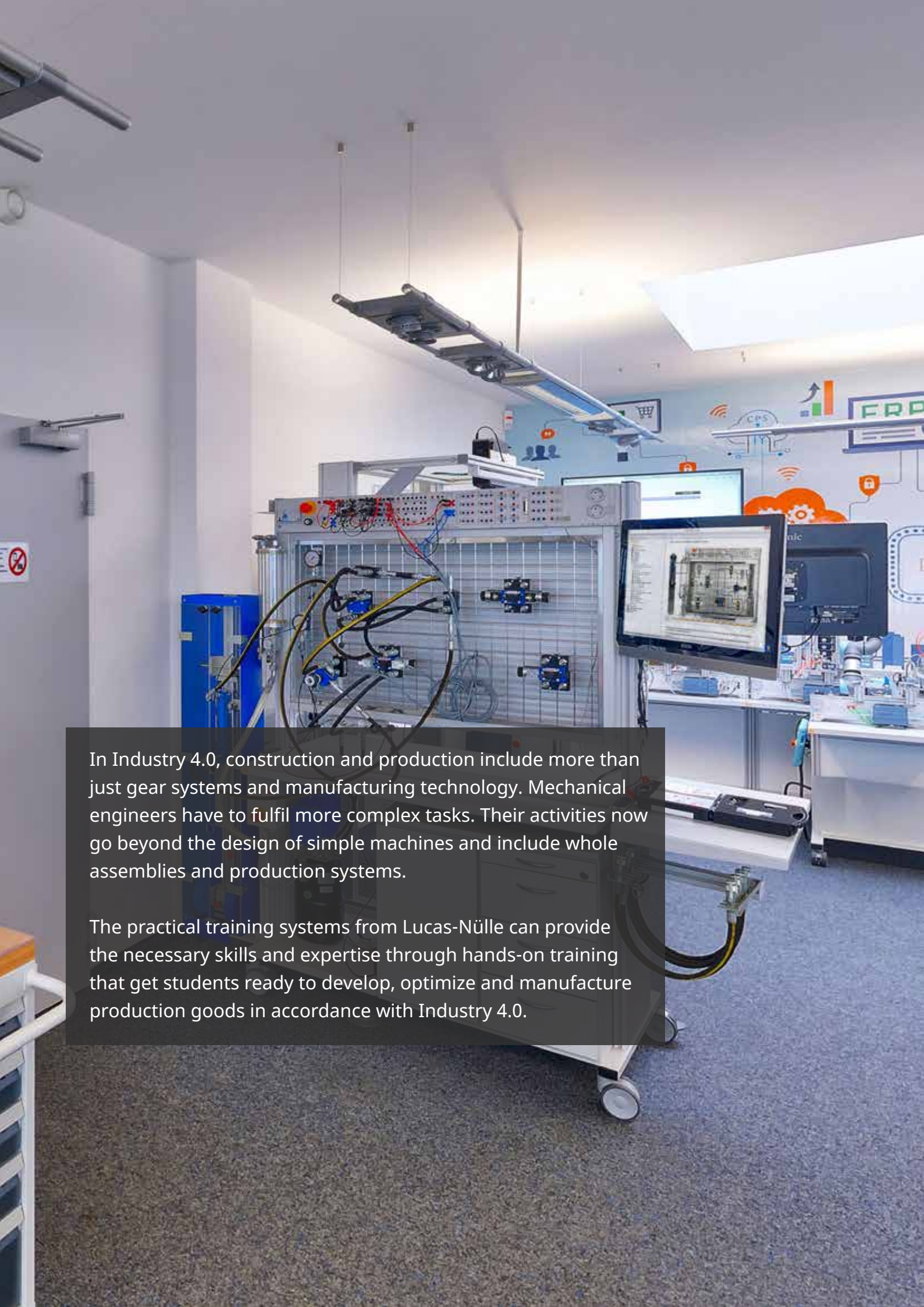


There is a host of statistical data located at the backend of the ERP system - for example on production times, interruption times, number of versions manufactured and customer evaluations. The orders are depicted in detail. Filter functions make it easy to find a customer's orders in certain time frames. Delivery receipts and invoices can be created and printed out in addition to the orders.

Benefits

- Freely configurable webshop
- Order via Internet
- Personalised ordering
- Different prices for different versions
- Delivery times shown
- Live view of production process
- Live view of order lists

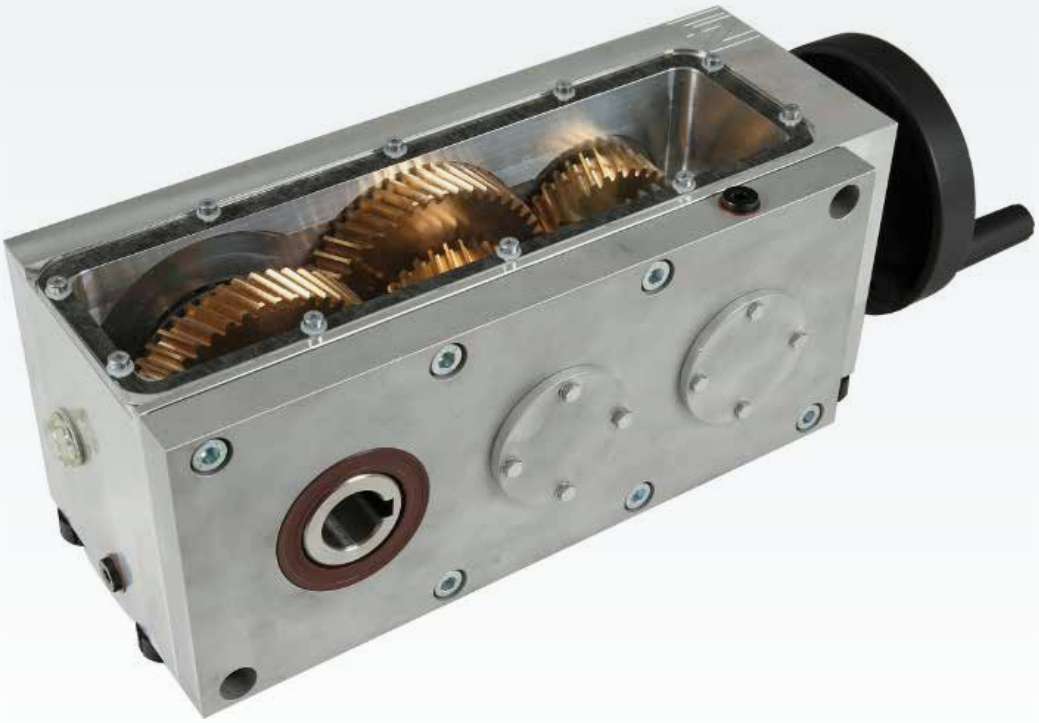
GEAR SYSTEMS AND PRODUCTION TECHNOLOGY



In Industry 4.0, construction and production include more than just gear systems and manufacturing technology. Mechanical engineers have to fulfil more complex tasks. Their activities now go beyond the design of simple machines and include whole assemblies and production systems.

The practical training systems from Lucas-Nülle can provide the necessary skills and expertise through hands-on training that get students ready to develop, optimize and manufacture production goods in accordance with Industry 4.0.

MEC 10 TRAINING SYSTEM FOR SPUR AND BEVEL GEARS

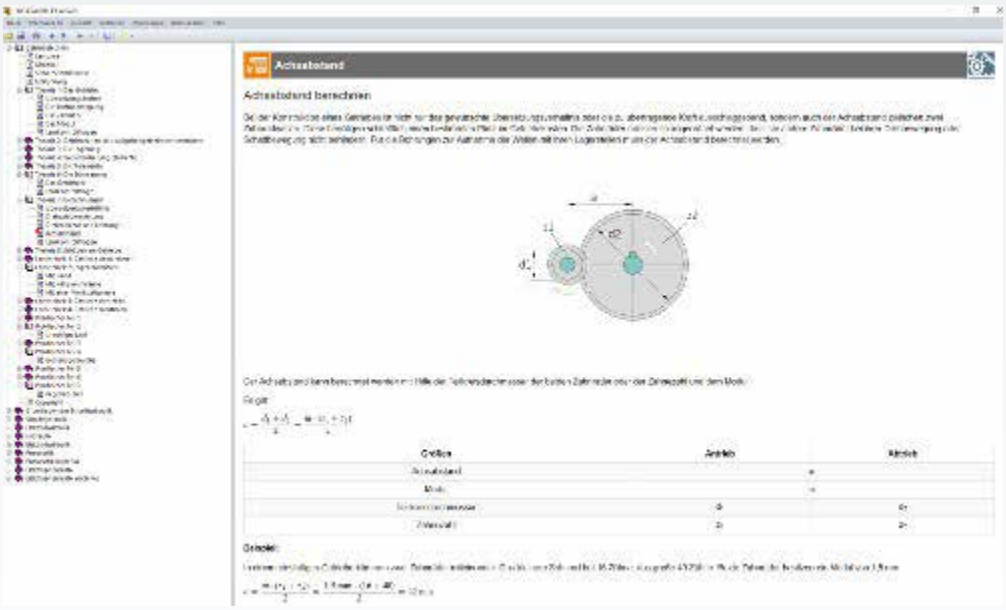


The gearbox training system is well suited to support instructors who train mechanics for industry and trade. It deals with all the learning fields required for industrial metalworking professions and covers a wide range of subjects.

Training contents

- Assembly and disassembly of the components
- Becoming familiar with how a gear system works
- How to handle the components
- Distinguishing the various types and applications of bearings
- Finding out about positive and non-positive locking
- Learning to handle the different kinds of seal
- Installation and de-installation without special inserting and extraction tools
- How to comply with current safety regulations
- Checking the training contents
- Option: flange-mounting of a three-phase motor and operation on the conveyor belt module

ILA COURSE ON GEAR SYSTEMS



With this digital Interactive Lab Assistant (ILA) course, important topics in gear system technology are taught. It is subdivided into various units. The general introduction covers the topics of equipment and safety. In the subsequent theoretical section, the user works through a series of learning units that are primarily focussed on the gearbox unit. The interactive question sections allow students to monitor their learning progress. Practical exercises round off the course. The practical applications are an essential aid to the user in achieving the training objectives and mastering the material for later use on the job. If there are knowledge gaps during the practical section, it is at all times simple to return to the theoretical section.

Training contents

Participants in the course:

- become familiar with the depiction and function of the technical components of a gear
- learn how a systematic visual and functional examination is carried out
- learn how to check easily accessible parts (bearings, gears, safety clutch) for wear and tear
- learn how to professionally maintain and repair the gearbox unit

There are no specific prerequisites in terms of gear system knowledge needed for the successful completion of this course. However, basic technical know-how in the relevant metalworking professions on the first-year level of vocational training is necessary.

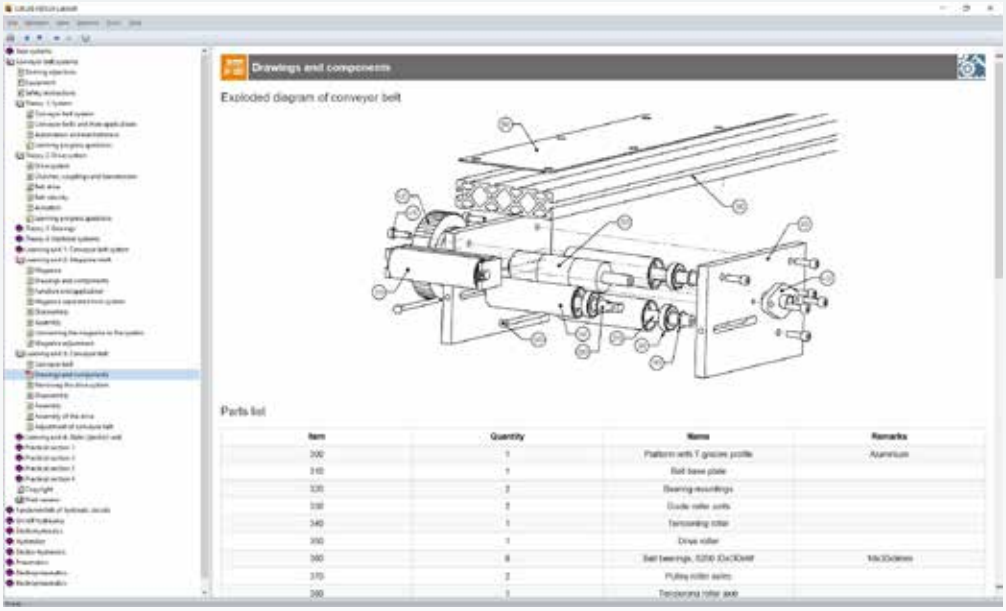
MEC 11 TRAINING SYSTEM FOR MODULAR CONVEYOR BELT TECHNOLOGY

Various, educationally designed components are combined into a comprehensive training system for this industry-like conveyor belt system. The spur/bevel gears can be examined through an acrylic inspection window. Furthermore, the three-phase motor can be flange-mounted directly to the gearbox. Combining a conveyor belt, a magazine, a slider module as well as a control switching cabinet and a maintenance unit with a manual valve, the system forms a comprehensive training unit for industrial mechanics.

Training contents

- Fundamentals of electrical engineering (extra-low voltage)
- Basics of open-loop control technology (LOGO programming)
- Set-up of the process control inside the switching cabinet as a VPS control or LOGO 8 configuration
- Assemble the pneumatic components
- Select and assemble other components (sensors, valves, cylinders)
- Implement customised projects

ILA COURSE ON CONVEYOR BELT TECHNOLOGY



The ILA course on conveyor belt technology is arranged in various units. The general section on safety and the introduction are followed by theoretical sections. To start with, the theoretical information needed is taught or reviewed. This is followed by the learning units which focus specifically on the conveyor belt system and which progress step-by-step. They also contain questions which can be used to check learning progress. After this is completed, smaller, practical assignments are included which assist in taking what has been learned and converting it into internalized know-how.

If while working through the practical section you notice that important knowledge is missing, it is easy to quickly jump back to the theoretical section and to review what you need to know.

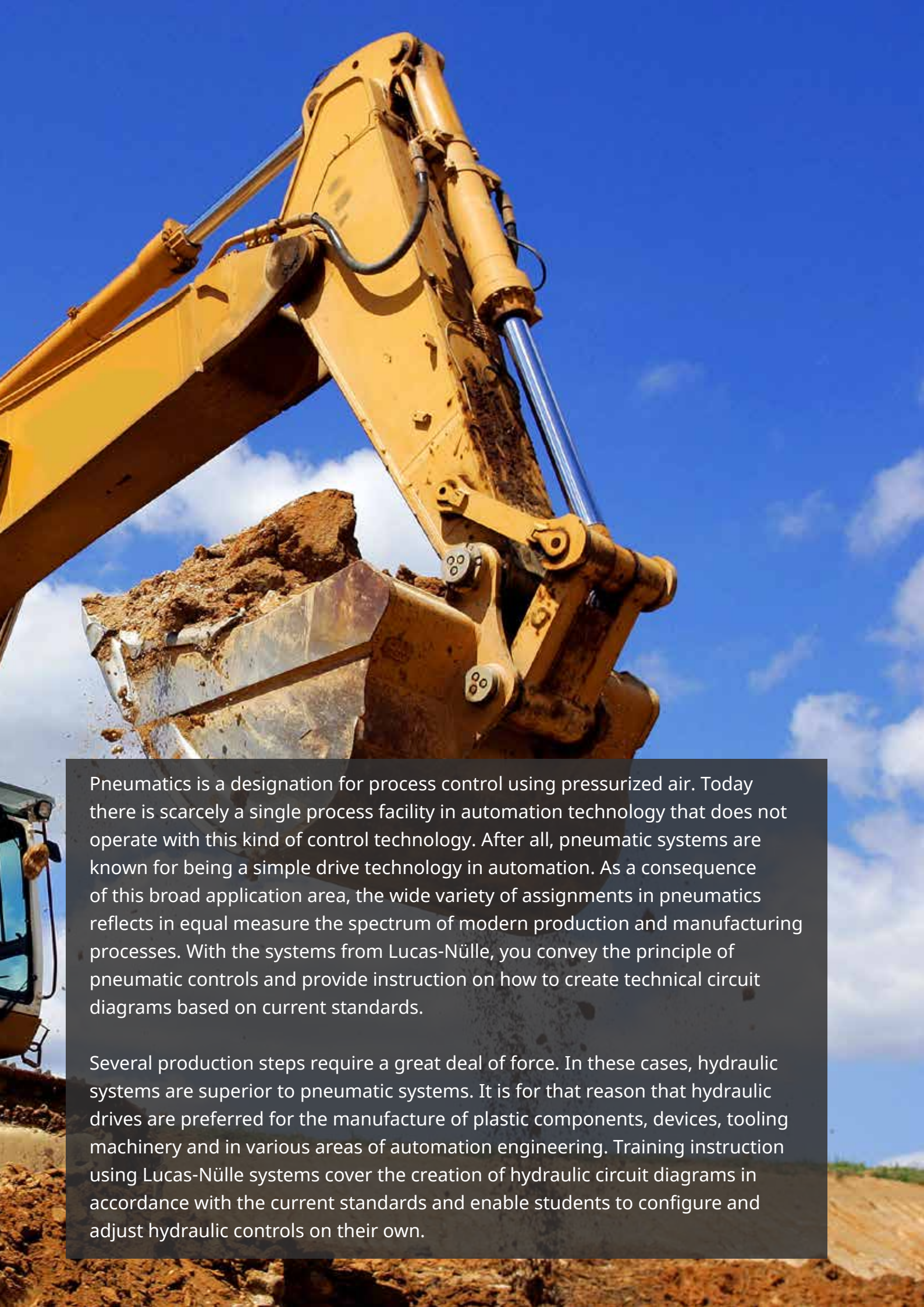
Training contents

The course participants will:

- become familiar with the depiction and operation of technical components of the conveyor belt system
- learn how to carry out a systematic visual and operational inspection of the conveyor belt system
- learn to distinguish, configure and adjust the required sensors
- learn how to professionally maintain and repair a conveyor belt and its components

Recommendation: You should complete the course on the gear system before starting this course. Basic technical know-how in the relevant metalworking professions on the first-year level of vocational training is necessary.

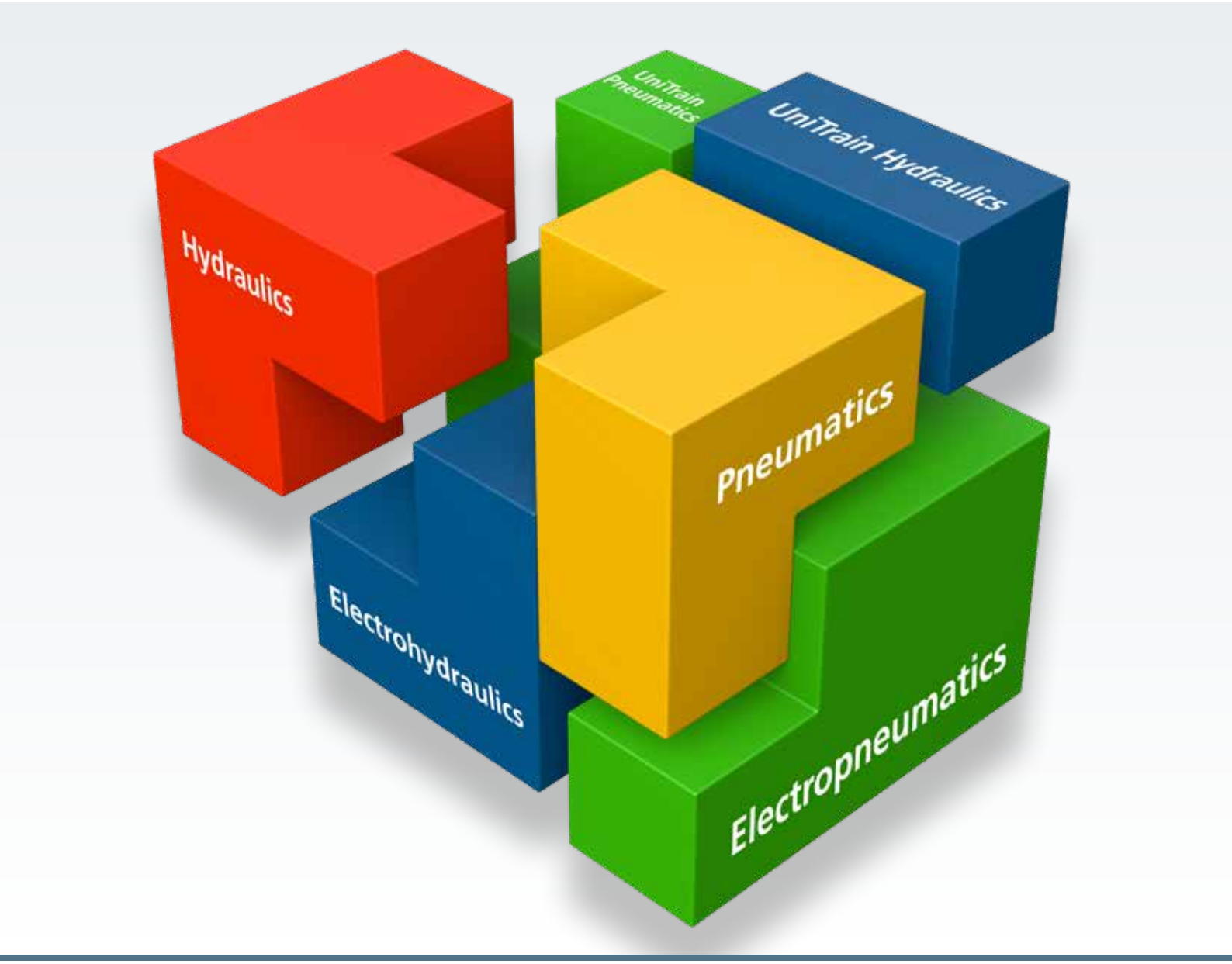
PNEUMATICS / HYDRAULICS



Pneumatics is a designation for process control using pressurized air. Today there is scarcely a single process facility in automation technology that does not operate with this kind of control technology. After all, pneumatic systems are known for being a simple drive technology in automation. As a consequence of this broad application area, the wide variety of assignments in pneumatics reflects in equal measure the spectrum of modern production and manufacturing processes. With the systems from Lucas-Nülle, you convey the principle of pneumatic controls and provide instruction on how to create technical circuit diagrams based on current standards.

Several production steps require a great deal of force. In these cases, hydraulic systems are superior to pneumatic systems. It is for that reason that hydraulic drives are preferred for the manufacture of plastic components, devices, tooling machinery and in various areas of automation engineering. Training instruction using Lucas-Nülle systems cover the creation of hydraulic circuit diagrams in accordance with the current standards and enable students to configure and adjust hydraulic controls on their own.

BUILDING BLOCKS TO SUCCESS



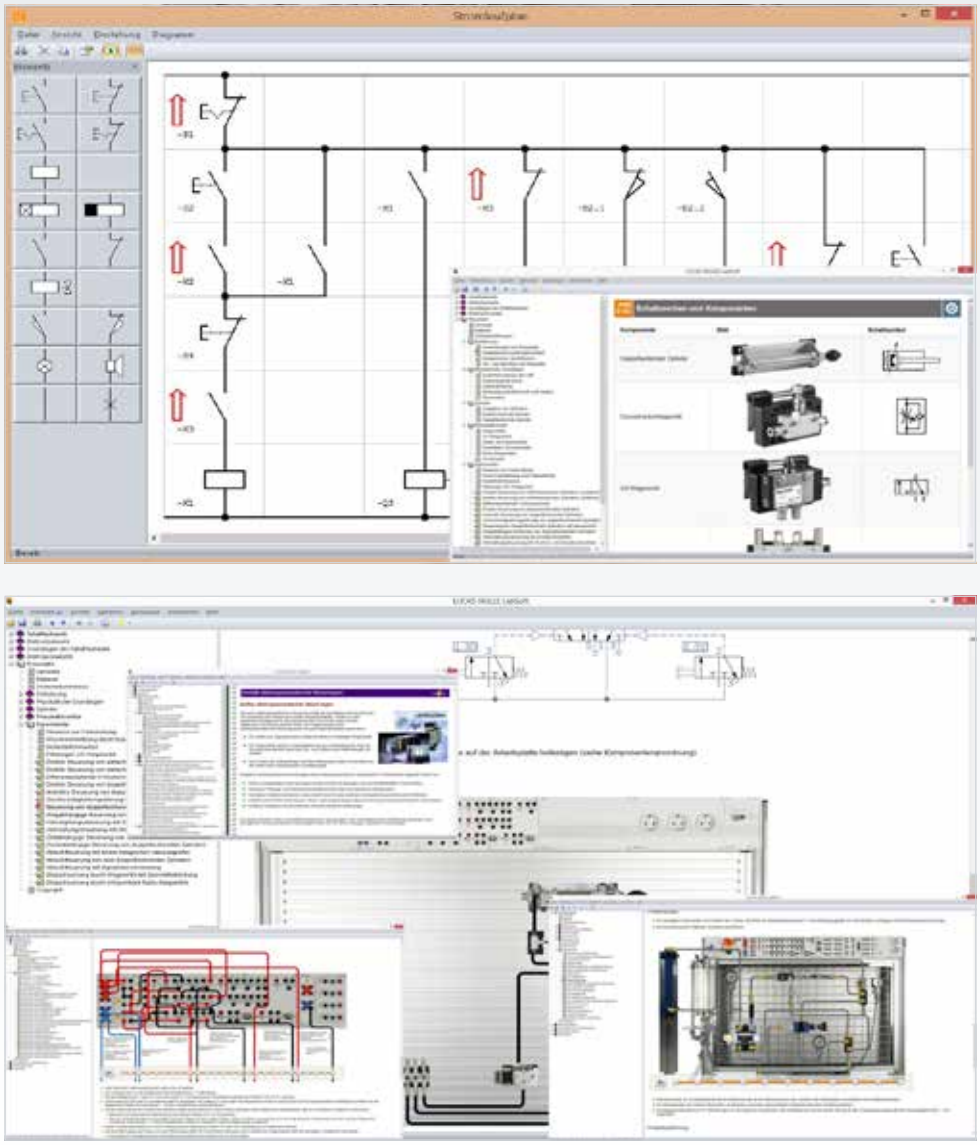
For over 40 years Lucas-Nülle has stood for progressive and innovative learning and has been supporting vocational education worldwide with training systems. Each training system fits perfectly into the overall educational concept of Lucas-Nülle and paves the way to successful training. Whether you wish to obtain a single training system or equip an entire laboratory: making your specific wishes come true is our passion.

Lucas-Nülle's overall concept takes the form of a building block system that supports students in successfully acquiring practical skills.

The student uses our UniTrain hydraulics and pneumatics board in the classroom to learn the initial steps of process control technology with interactive training material.

The mobile experiment stands equipped with industrial components from hydraulics and pneumatics are used in combination with animations and experiments to impart complex training content in fluid technology.

COMPUTER-BASED LEARNING ENVIRONMENT – INTERACTIVE LAB ASSISTANT (ILA)



ILA course with set-up animation
interactive circuit diagram editor

Complex training material presented vividly:
The ILA course assists you when carrying out the experiments. It not only provides experiment instructions but also valuable theoretical information, it records measurement values and automatically creates laboratory documentation as a printout or PDF document. Furthermore, you can use the LabSoft Classroom Manager to modify or supplement the training content.

Benefits

- Theoretical material is imparted with easy-to-understand animations
- Support for experiment procedure
- Interactive demonstration of experiment set-ups
- Access to real measuring and testing equipment with comprehensive evaluation possibilities
- Practice-oriented project assignments succeed in rounding out the learning experience
- Integrated operating instructions
- Documentation of the experiment results (compilation of an experiment report)
- Knowledge questions incl. feedback function
- Integrated optional Automation Studio™ software

THIS IS HOW YOUR TRAINING SYSTEM COULD LOOK – SELECT YOUR EQUIPMENT SET

- Connectable on one or both sides
- With service module, interface and USB port

Obtainable in 3 versions:
- **Pneumatics / Electropneumatics**
- **Hydraulics / Electrohydraulics**
- **Hydraulics / Pneumatics**

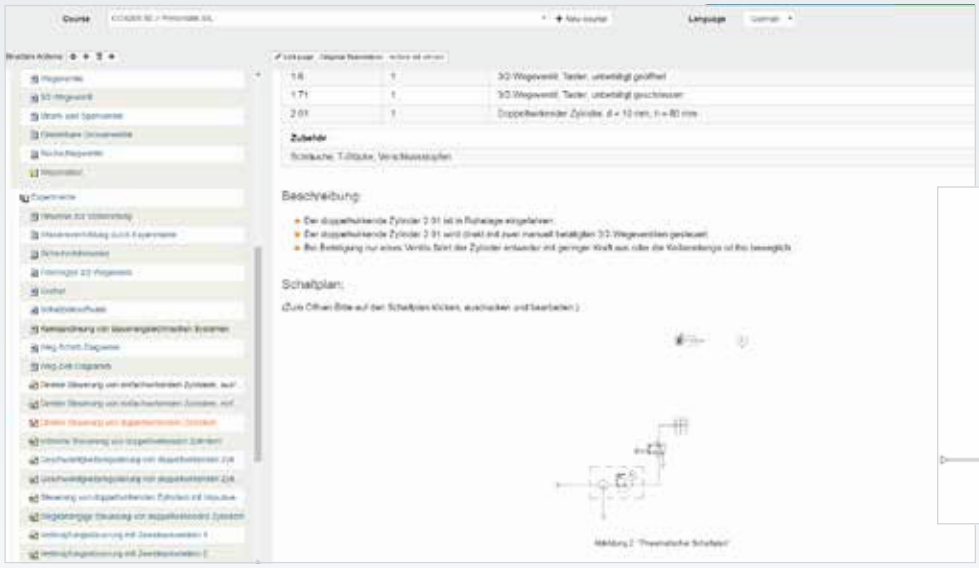
PNEUMATICS TRAINING SYSTEM

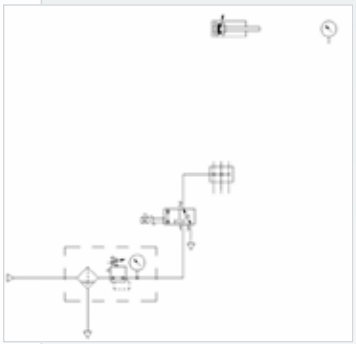
UNITRAIN
SYSTEM

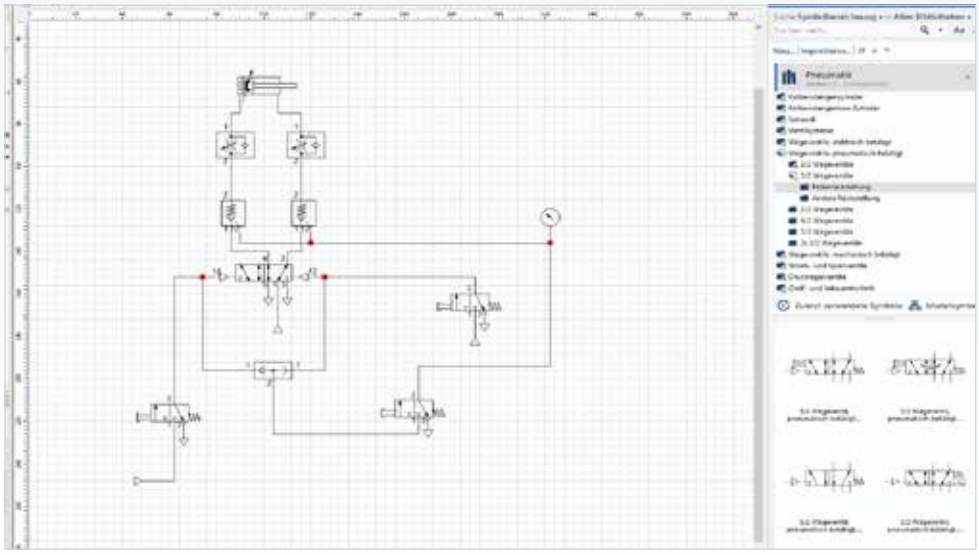
Pneumatics compact trainer
The UniTrain course on pneumatics teaches the know-how needed for the control and maintenance of modern process automation. The fundamental features of industrial components are explored using animations and experiments on real systems.

Training contents
- Fundamentals of pneumatics
- How single- and double-acting cylinders work
- Getting to know various directional valves
- How pneumatic controls are designed and function
- Hard-wired controls
- Programmable controls
- Recording of distance-time diagrams
- Time-dependent control

Art. no. CO4205-5E







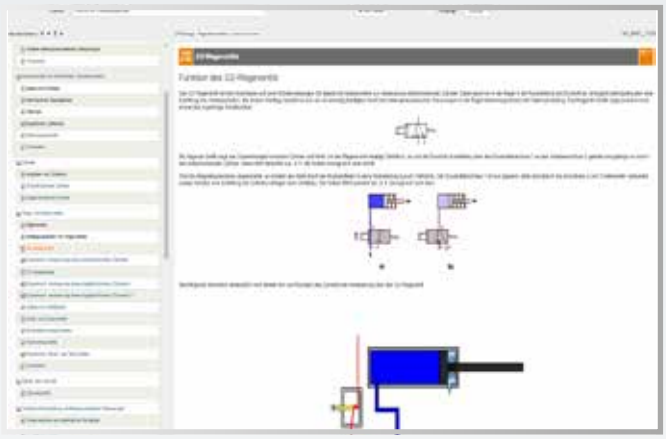
Experimenting the safe way with the UniTrain multimedia course

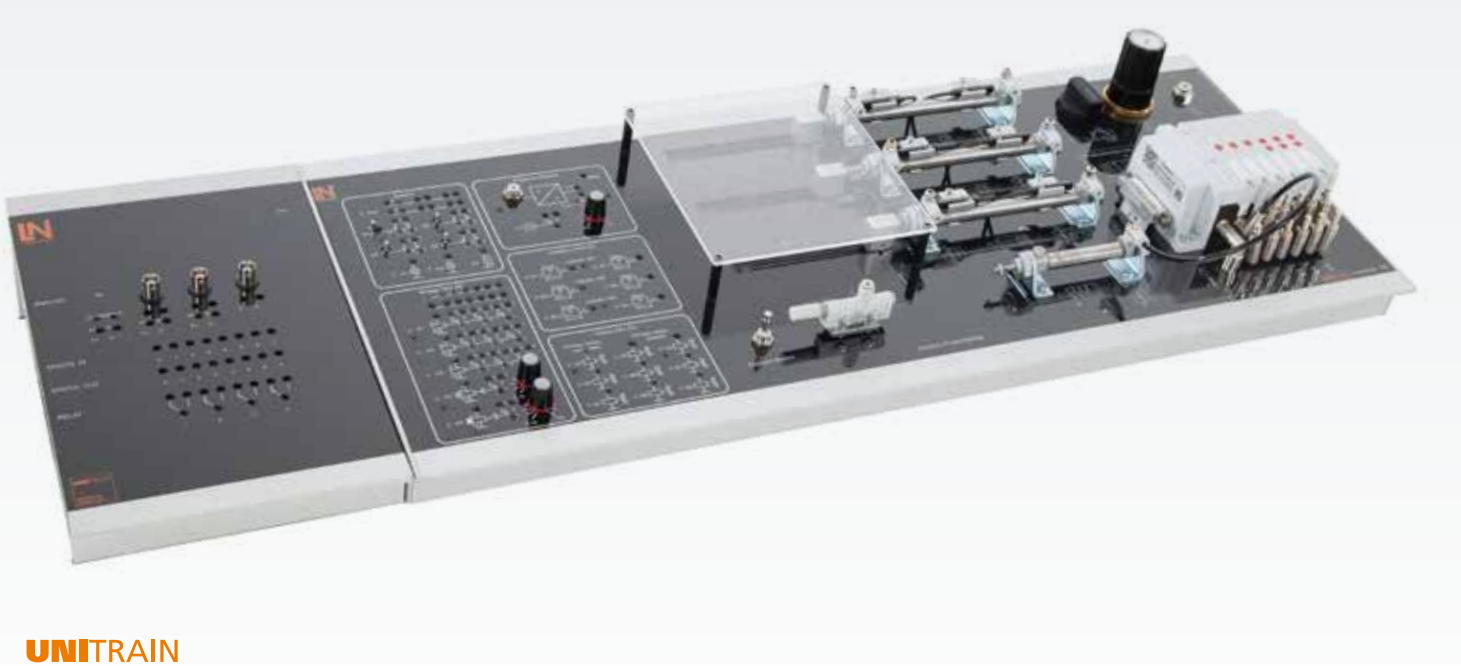
In addition to the pneumatics training system, the UniTrain multimedia course offers a PC-based evaluation of measurement data and fault simulation.

Benefits

- Interactive multimedia course
- Set-up animations
- Deployable in every classroom
- Interactively create distance-time diagrams

ELECTROPNEUMATICS TRAINING SYSTEM



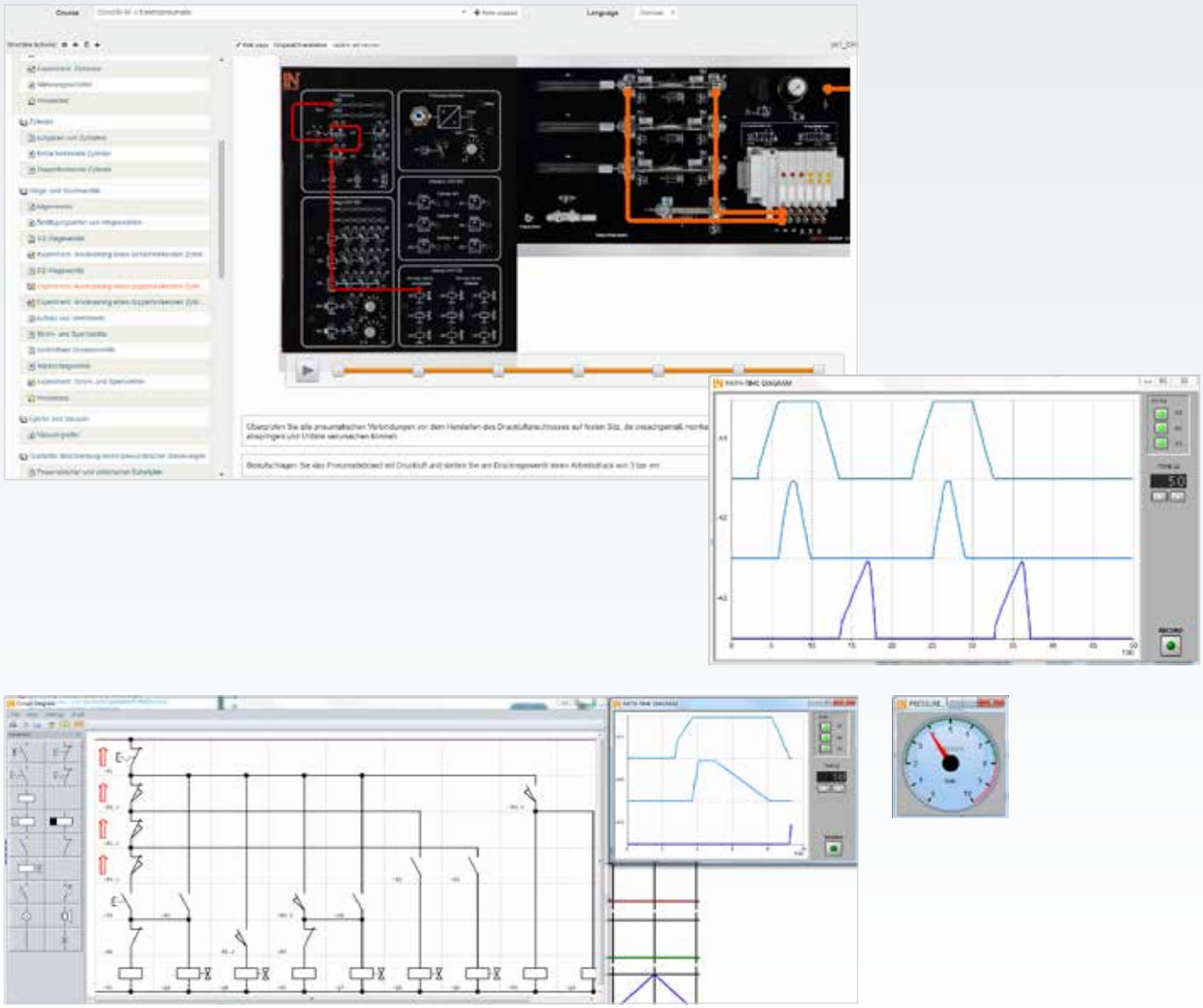


UNITRAIN
SYSTEM

Electropneumatics compact trainer
For the control and maintenance of modern process automation, our electropneumatics UniTrain course imparts all the necessary know-how. The basic features of industrial components are explored using animations and experiments on real systems.

Training content
- Fundamentals of electropneumatics
- How single- and double-acting cylinders work
- Becoming familiar with various directional valves
- How electropneumatic controls are designed and function
- Hard-wired controls
- Programmable controls
- Recording of distance-time diagrams
- Time-dependent control

Art. no. CO4205-5F



Experimenting the safe way with the UniTrain multimedia course

In addition to the electropneumatics training system, the UniTrain multimedia course offers PC-based evaluation of measurement data and fault simulation

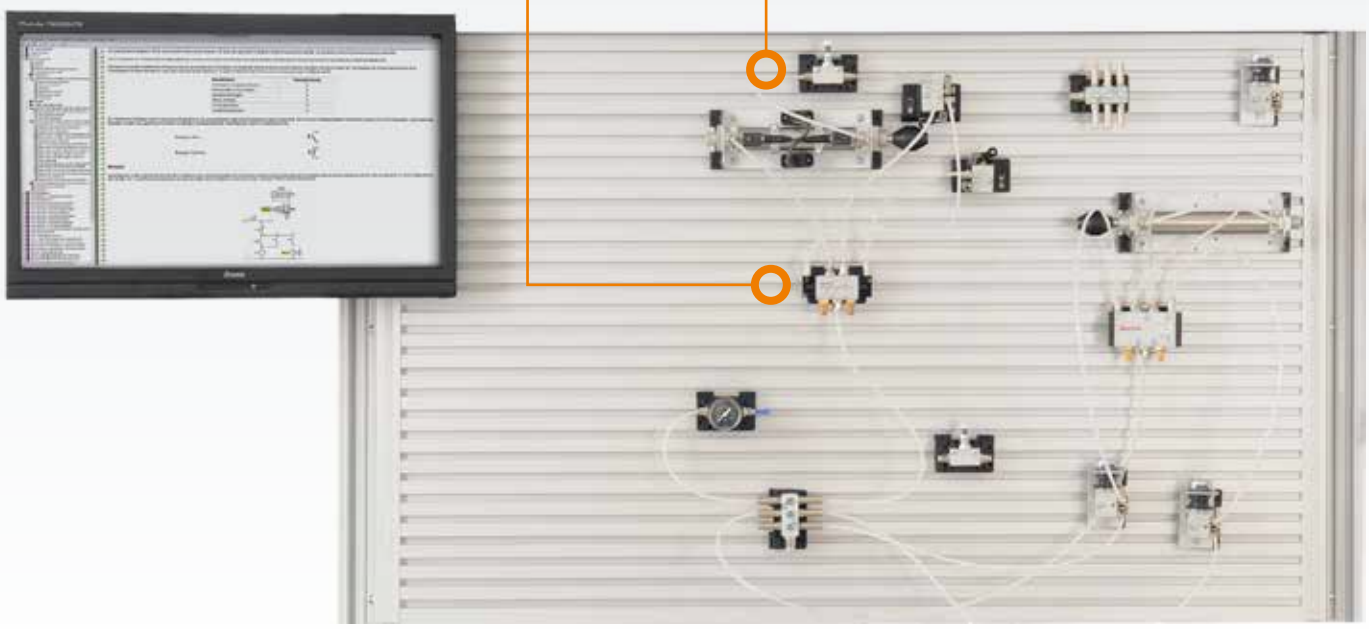
Benefits

- Interactive multimedia course
- Set-up animations
- Deployable in every classroom
- Interactively create distance-time diagrams
- Direct control of the hardware with interactive circuit diagram editor

PNEUMATICS TRAINING SYSTEM

Patented "snap-in" mounting mechanism

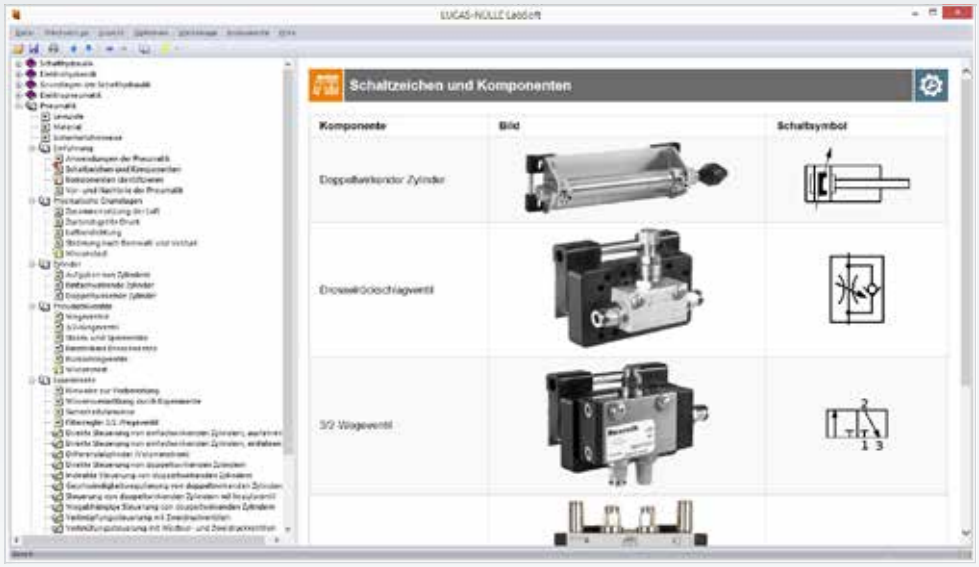
Standard industrial components



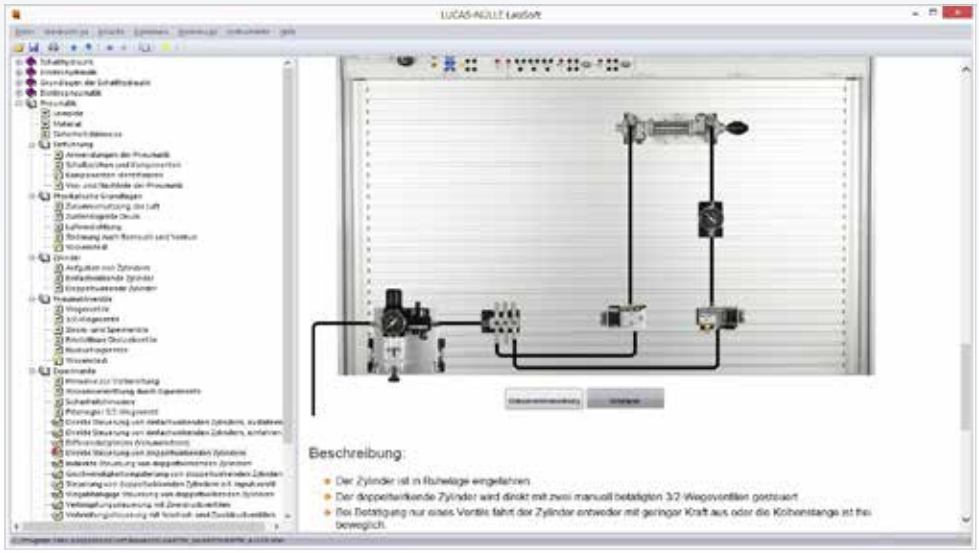
Manually operated pneumatics
Equipped with authentic industrial components and the patented "snap-in" mounting mechanism, the pneumatics training system is a cutting-edge system for vocational and advanced training.

Training content
- Direct/indirect control of single- and double-action cylinders
- Path-dependent process controls
- Control of double-action cylinders using pulse valves
- Logic controls with exchange and two-pressure valves
- Pressure- and time-dependent controls
- Sequential control with pneumatic proximity switch

Art. no. PBC 11



Teaching the fundamentals in the pneumatics course



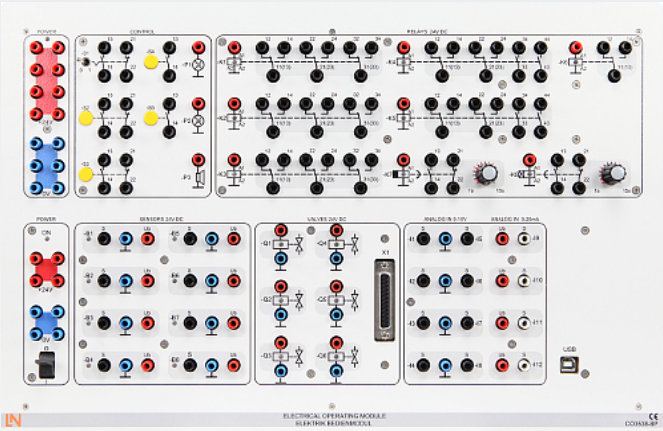
Step-by-step set-up animations in all courses

Testing learning progress with the ILA course

Benefits

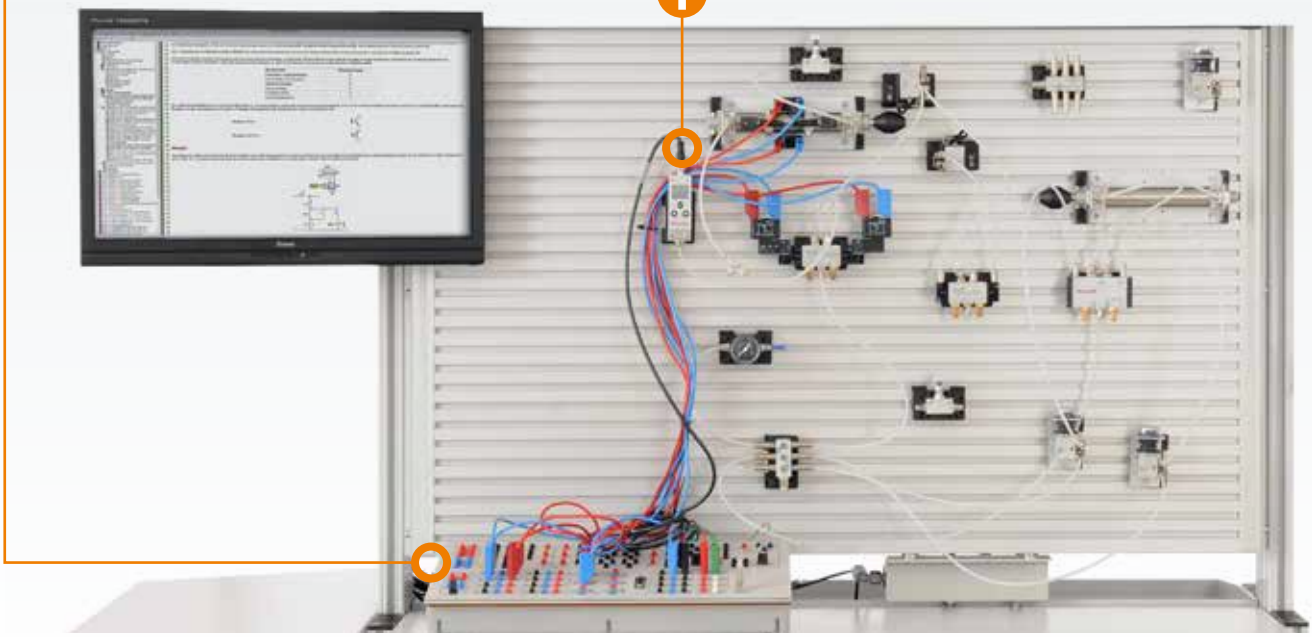
- Step-by-step instructions using multimedia
- The physical principles are explained using easy-to-understand animations
- PC-based evaluation of measurement data
- Virtual measuring instruments are started directly from within the experiment instructions

ELECTROPNEUMATICS TRAINING SYSTEM



Interactive interface for the circuit diagram editor

Real industrial components with the patented snap-on mounting mechanism



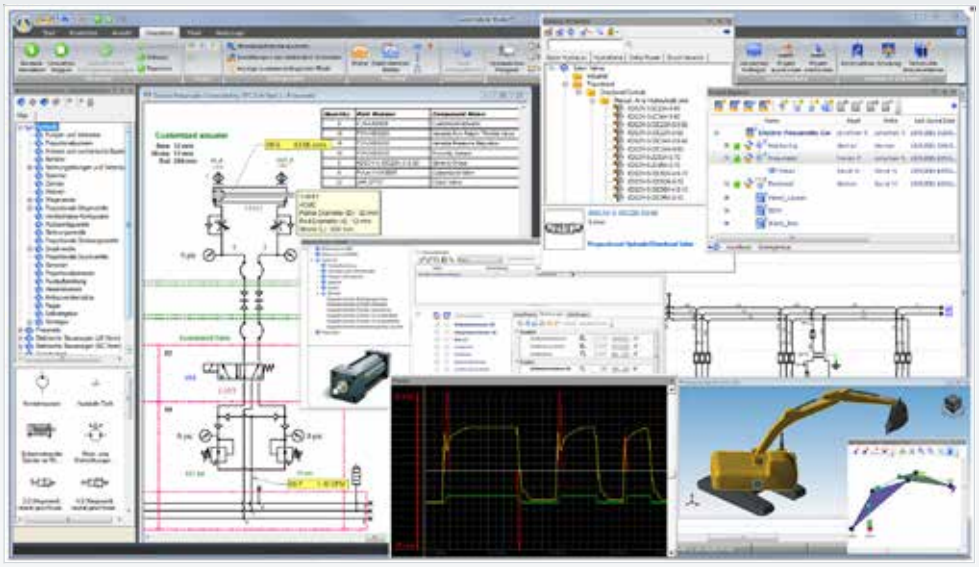
Electrical supplement to industrial pneumatics

With the electropneumatic component supplement, it is possible to carry out project-related exercises in electropneumatics. The electropneumatic components are functionally connected via an electric control console. Alternatively, this can also be carried out using the service module located in the power duct.

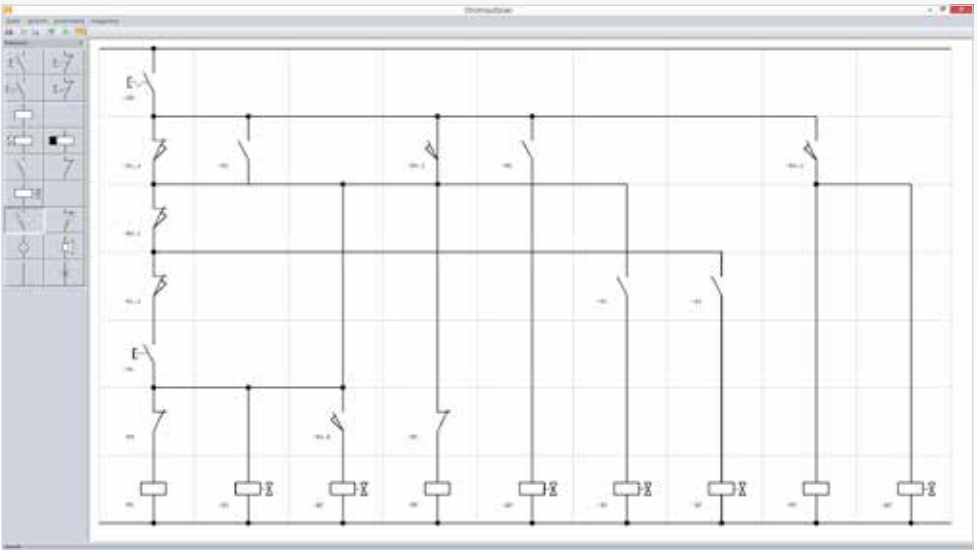
Training contents

- Function and use of electropneumatic components
- Setting up relay and self-holding controls
- Time- and process-based sequence control system
- Path-dependent process controls with sensors and presetting counters
- Program control with clock cycle

Art. no. PEC 11



Automation Studio™, control of pneumatics components using the OPC interface



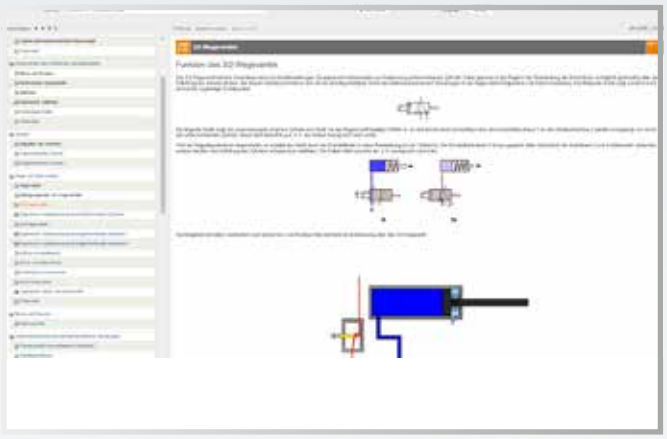
Interactive circuit diagram

Direct control of hardware from the ILA course itself

Benefits

- Interactive control of hardware from the ILA course
- Use Automation Studio™ to create circuit diagrams
- Open the interactive circuit diagram editor from the ILA course
- Open the measuring instruments from the ILA course
- Control and measurement data acquisition via USB

HYDRAULICS / ELECTROHYDRAULICS TRAINING SYSTEMS



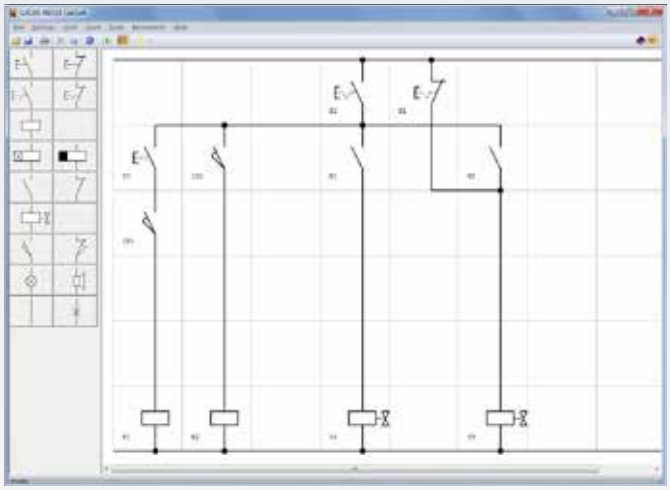
Work safety guaranteed
thanks to a leak-free hose system

UNITRAIN
SYSTEM

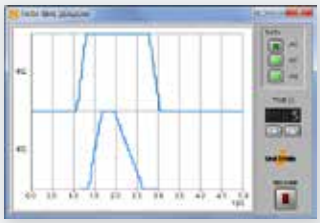
Hydraulics compact trainer
Thanks to leak-free hose connections, work can be done safely and cleanly in the classroom even up to a pressure of 40 bar. The accompanying UniTrain self-study course guides the trainee through all the basics of hydraulics. Create logic operations in the software in the integrated circuit diagram or use cables to connect up the integrated control elements in the conventional way on the board to complete a required project.

Training contents
- Fundamentals of hydraulics / electrohydraulics
- Hydraulic and electrical circuit diagrams
- Recording of distance-time diagrams
- Basic logic circuits with AND / OR operations
- Path-dependent process controls

Art. no.
Hydraulics SO4205-8A
Electrohydraulics SO4205-8B (excl. accessories)

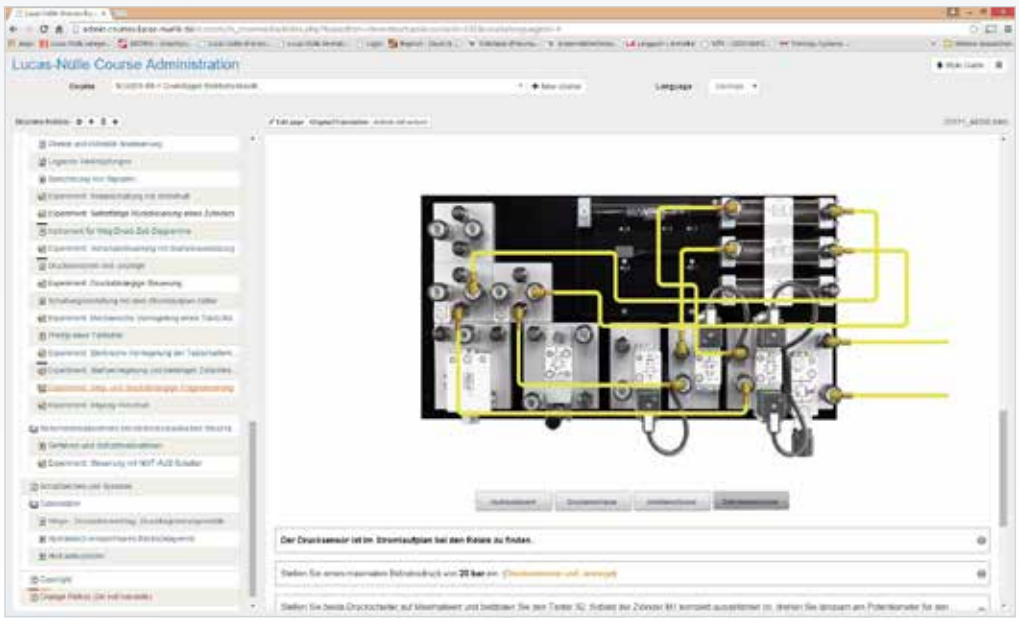


Interactive circuit diagram editor



Distance-pressure-time diagram for pressure-dependent process control

Pressure gauge



Hose connection animations in the UniTrain course

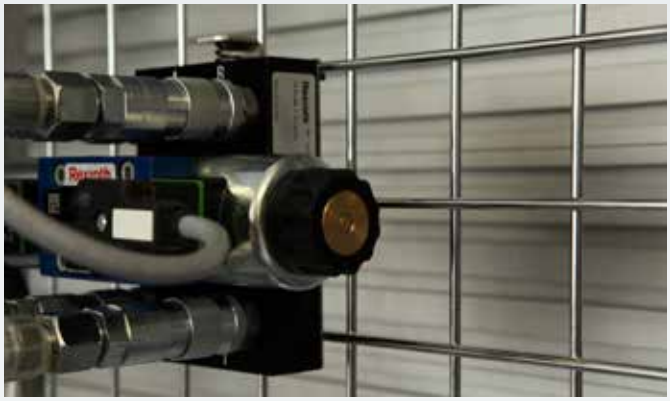
Direct control of hardware from the ILA course

Benefits

- Compact, portable hydraulic system with a constant pressure pump
- Self-sealing hydraulic hose connections with low oil leakage
- Interactive multimedia course
- Activate instruments directly from the multimedia course
- Control the hardware using the interactive circuit diagram editor

HYDRAULICS TRAINING SYSTEM

Customized: 4/3-way valve for vocational training and developing skills

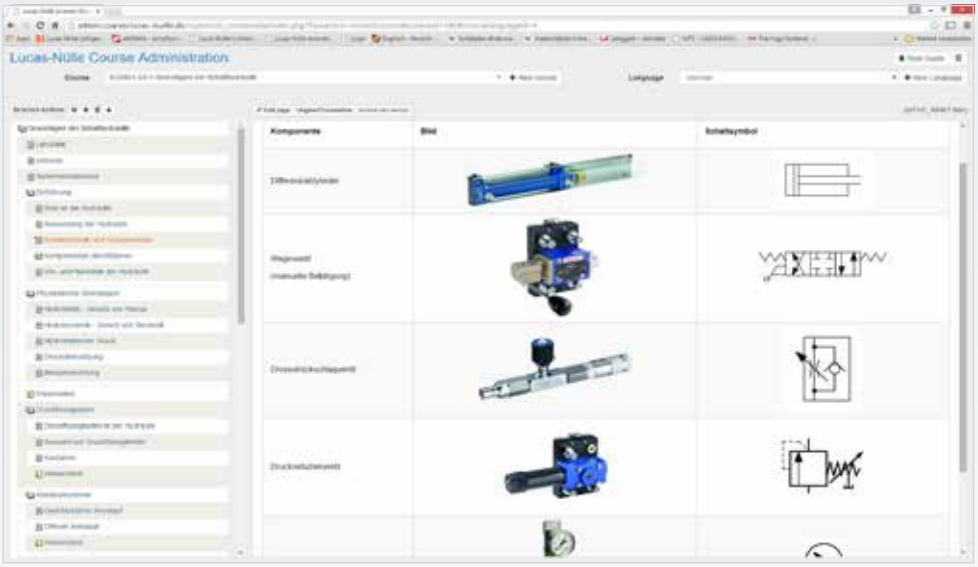


Standard industrial components

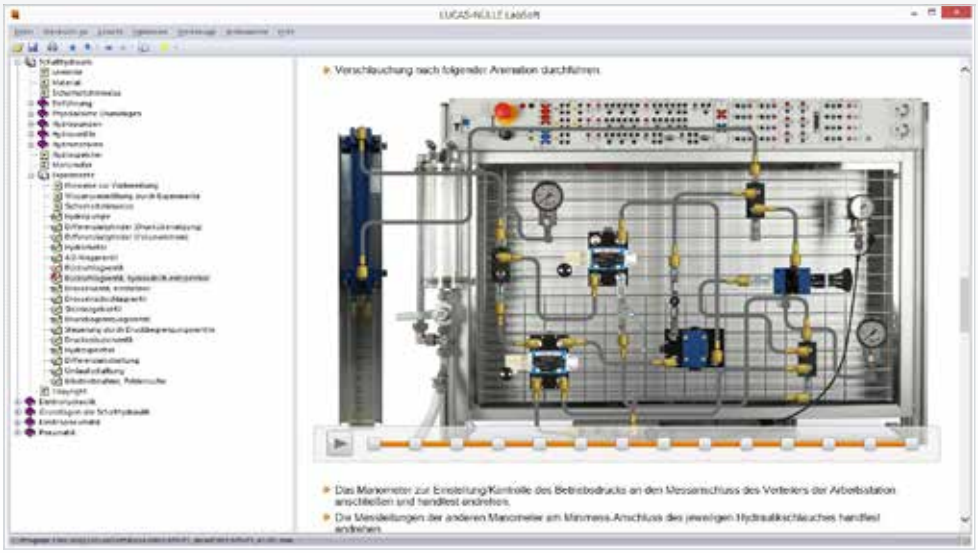
Manually operated hydraulics
Real industrial components and our patented "snap-in" mounting mechanism make the hydraulics training system a cutting-edge system for vocational and advanced training.

Training contents
- Direct/indirect control of single- and double-action cylinders
- Path-dependent process controls
- Control of double-action cylinders using pulse valves
- Logic controls with exchange and two-pressure valves
- Pressure- and time-dependent controls
- Sequential control with pneumatic proximity switch

Art. no.
Basic equipment set HBC 10
Supplementary equipment set HBC 11



Detailed visualisation of the hardware



ILA supports the interactive set-up animator

Carry out projects with the ILA course

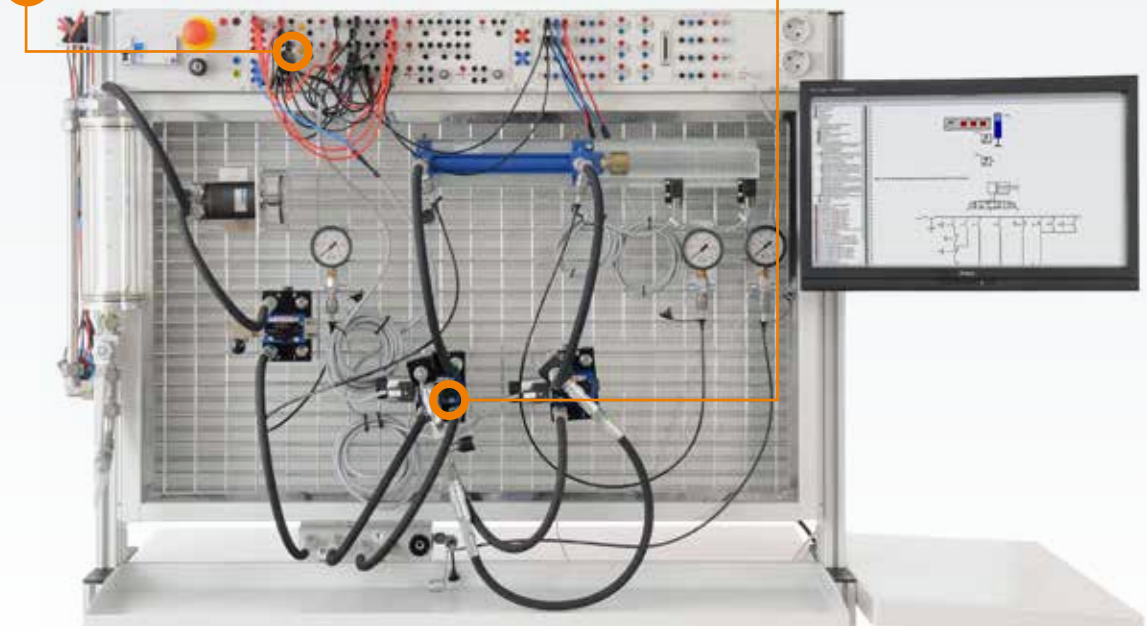
Benefits

- Use standard industrial components
- Set-up animations included in the interactive multimedia course
- Excellent monitoring of forces arising thanks to interactive measuring instruments
- Lots of freedom to arrange the component configurations
- High operating pressures are possible

ELECTROHYDRAULICS TRAINING SYSTEM

Customized: 4/3-way valve
for training and developing skills

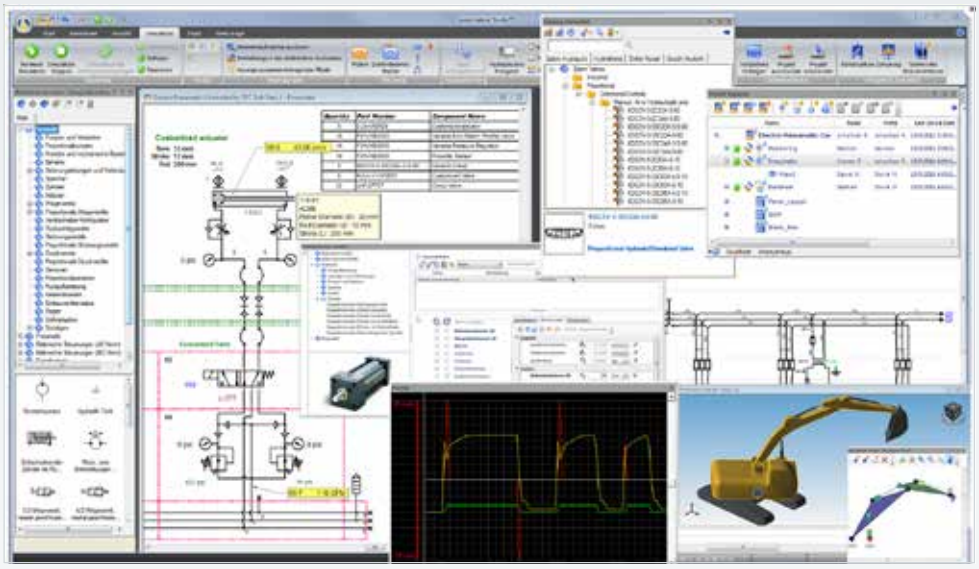
Standard industrial components



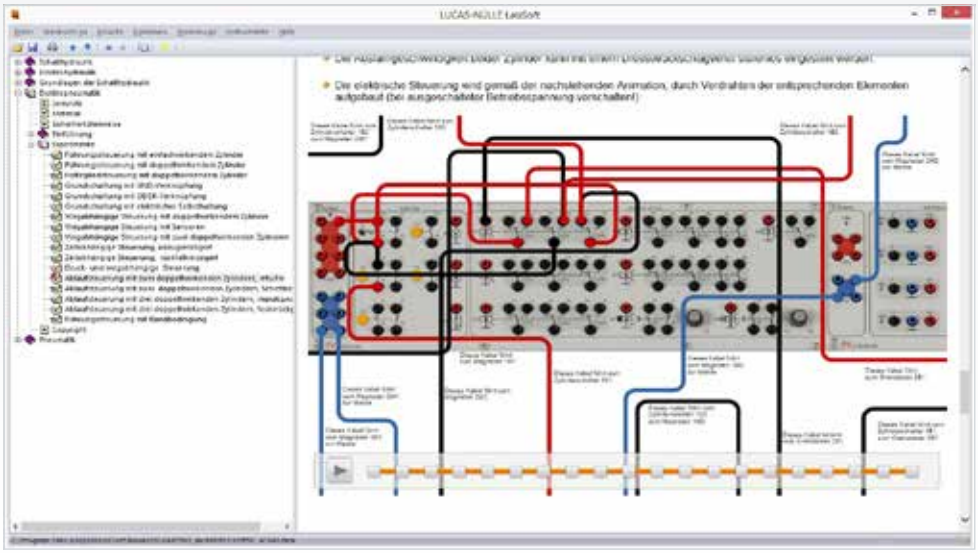
Electrical supplement to industrial hydraulics
Core skills and technical qualifications are imparted by including autonomous planning, implementation, and inspection in all practice-oriented project assignments. The system is rounded off with components from Bosch Rexroth.

Training contents
- Exploring pressure-volume characteristics
- Pressure transmission in differential cylinders
- Open-loop control using directional valves
- Relationship between opening cross-section / pressure differential / volumetric flow rate
- Process control of the hydraulic drive

Art. no. HEC 11



Direct hardware control via the interface



Electrical wiring as set-up animation in the ILA course

Control the hardware with the ILA course and Automation Studio™

Benefits

- Use of real industrial components
- Work with the simulation software Automation Studio™
- Direct evaluation of the interactive knowledge test
- Step-by-step animation as set-up instructions for wiring and hose connections
- Easy to operate simply by starting the controls from the course itself

LUCAS-NÜLLE

LUCAS-NÜLLE GMBH

Siemensstr. 2
50170 Kerpen, Germany

Tel.: +49 2273 567-0
Fax: +49 2273 567-69

www.lucas-nuelle.com
export@lucas-nuelle.com

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