

FESTO

Room concepts

Innovative learning environments for modern teaching

Promote competencies

The learning space as a second teacher?

A number of research projects by well-known institutions show that the learning environment has a decisive influence on learning behavior. This is how the design of the learning space affects on different factors, such as creativity, productivity and the ability to think of the learners - according to the motto “the learning space as a second teacher”.



We have made it our mission to explore the potential of learning spaces. With the aim of maximizing individual learning success in the field of technical training and continuing education, we design and equip learning spaces according to the most modern industrial criteria. In doing so, we benefit from our furnishing concept, which has matured over the years and which is characterized by its high degree of flexibility and modularity. Paired with the necessary conceptual, architectural know-how and wealth of ideas, we will work with you to design a room solution that is ideally suited to your individual situation.

With this brochure we invite you to dive into the world of interior design together with us. We would like to give you interesting insights into the diverse range of topics related to the conception of our room solutions. We will show you what an exemplary room in mechatronics training can look like in reality using reference projects that have already been implemented. In this way, we would like to provide you with orientation approaches for the design of your own room solution.

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Sustainable and future-oriented

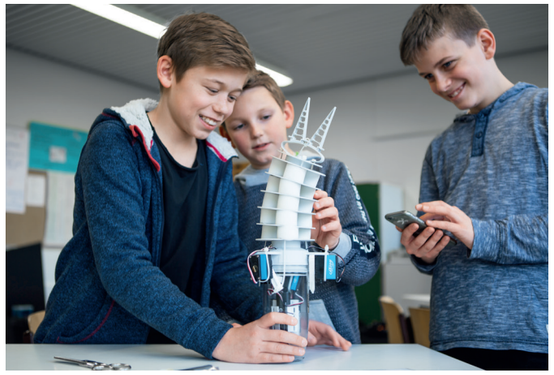
Promote competencies

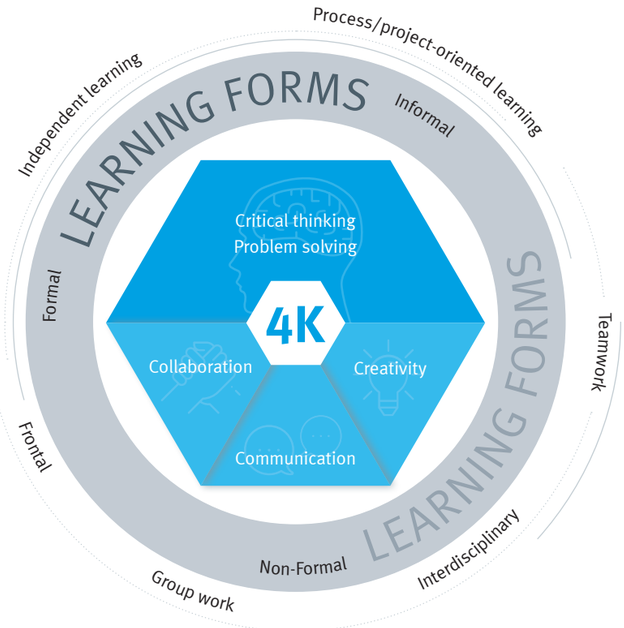
By linking the four core competencies listed below for the digital age, and the associated forms of learning, new forms of teaching are also emerging. Flexible learning spaces specifically promote their implementation.











Collaborative
In the world of work and in social life, collaborative work is very important. For this reason, it is important to develop these skills at an early age. Teaching based on collaborative work enables learners to work together in groups on a solution.

Creative
For problem solving, it is important that everyone involved is willing to experiment and explore new avenues. The development of unusual ideas helps to promote process- and problem-oriented action in everyday professional life.

Communicative
Well-functioning networks are very important for independent and interdisciplinary learning. They also promote the exchange of knowledge among each other and mutual support.

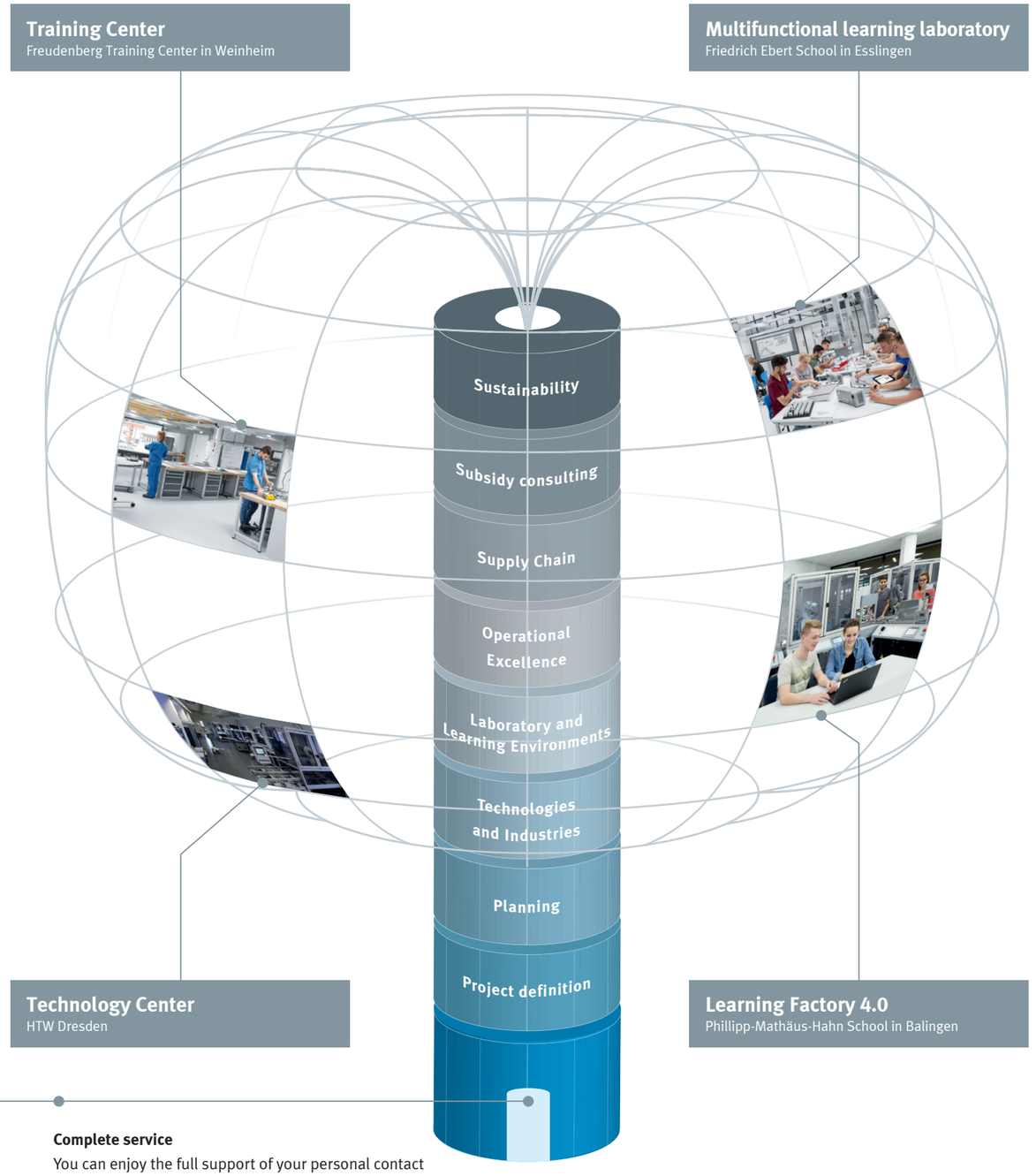
Critical
To be open to new approaches requires that you also take a critical look at your own actions in order to be able to approach processes and questions from different perspectives

Holistic approach

Our range of services

Your key to success is a holistic educational solution tailored to your needs and goals.





Target
To ensure that your financial and training objectives are achieved across the board, we support you from the start of the project in defining and covering your specific training requirements. Festo connects education with industry to ensure students are qualified and prepared for real industrial requirements.

Range of services
Build on the unique range of learning systems and technologies when designing, planning and equipping your individualized laboratories or workshops.
- Industrial training centers
- Vocational training centers
- Laboratories for universities and colleges
- Learning factories for research and science

Complete service
You can enjoy the full support of your personal contact from day one. During the entire duration of the project and at every phase of the project, you receive everything from a single source: project planning, project management, installation, commissioning and maintenance. For your sustainable success, we offer you a complete service for turnkey education projects in more than 53 countries around the world.

Project definition and planning

Our approach

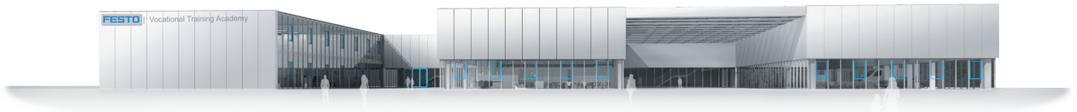
Through our longstanding and productive exchange of knowledge and experience with the industry, your qualification needs can be precisely defined.



Project definition
Rely on our experience and expertise to define your educational requirements right from the start. Whether you want to replace existing equipment with new systems, or establish a new field of knowledge in your educational institution - our employees advise you worldwide at the highest level.

Project planning
Benefit from optimal laboratory use during the design phase with educational equipment that is tailored to industrial requirements and can be used flexibly. We work with the latest planning tools for maximum efficiency during the planning process.

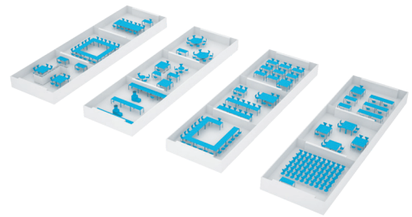
Spatial planning
Security and functional design are at the focus of space and building planning. We consult with our partners, coordinate with architects and carry out on-site and safety analyses. You will receive detailed 2D and 3D CAD plans that realistically depict your wishes before they are implemented.



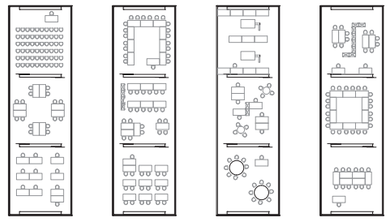




Step 1: Brainstorming
Together we sound out and define your needs - with good ideas for efficiency and cost reduction, such as multiple use of learning rooms. Together we determine which programs and equipment you actually need - and which you don‘t.



Step 3: 3D planning
Laboratory plans in 3D inspire and motivate through their closeness to reality. As a result, they often facilitate the provision of funds and budgets as a persuasive aid.



Beispiel 1 Beispiel 2 Beispiel 3 Beispiel 4

Step 2: 2D planning
A room concept in 2D enables the exchange of opinions on different layout possibilities. It illustrates the development of room and laboratory plans to match your qualification needs that your educational institution wishes to fulfill.

In three steps - professional laboratory design for every requirement.

Advantages at a glance

Our building blocks



Our stationary solution

- Stationary workstation systems with high functionality
- Few basic components for modular, individual construction
- Adjustable profile plate for individual exercise arrangements
- Integrable supply channel with pneumatic, electrical and data interfaces



Our complementary equipment

- Functional cabinet systems
- Ergonomic chairs in various designs complete the workstations
- Tables and upholstered furniture
- Projection screens, projectors, e-boards etc. also create creative zones for mutual exchange, discussions and joint learning



Our highly flexible approach

- Flexible, mobile workstation systems for designing different learning situations
- Optimal use of space thanks to the space-saving arrangement of the frames and foldable tables
- Trolleys as storage furniture and standing workstation at the same time
- Universal mounting frame for frames for various interchangeable components



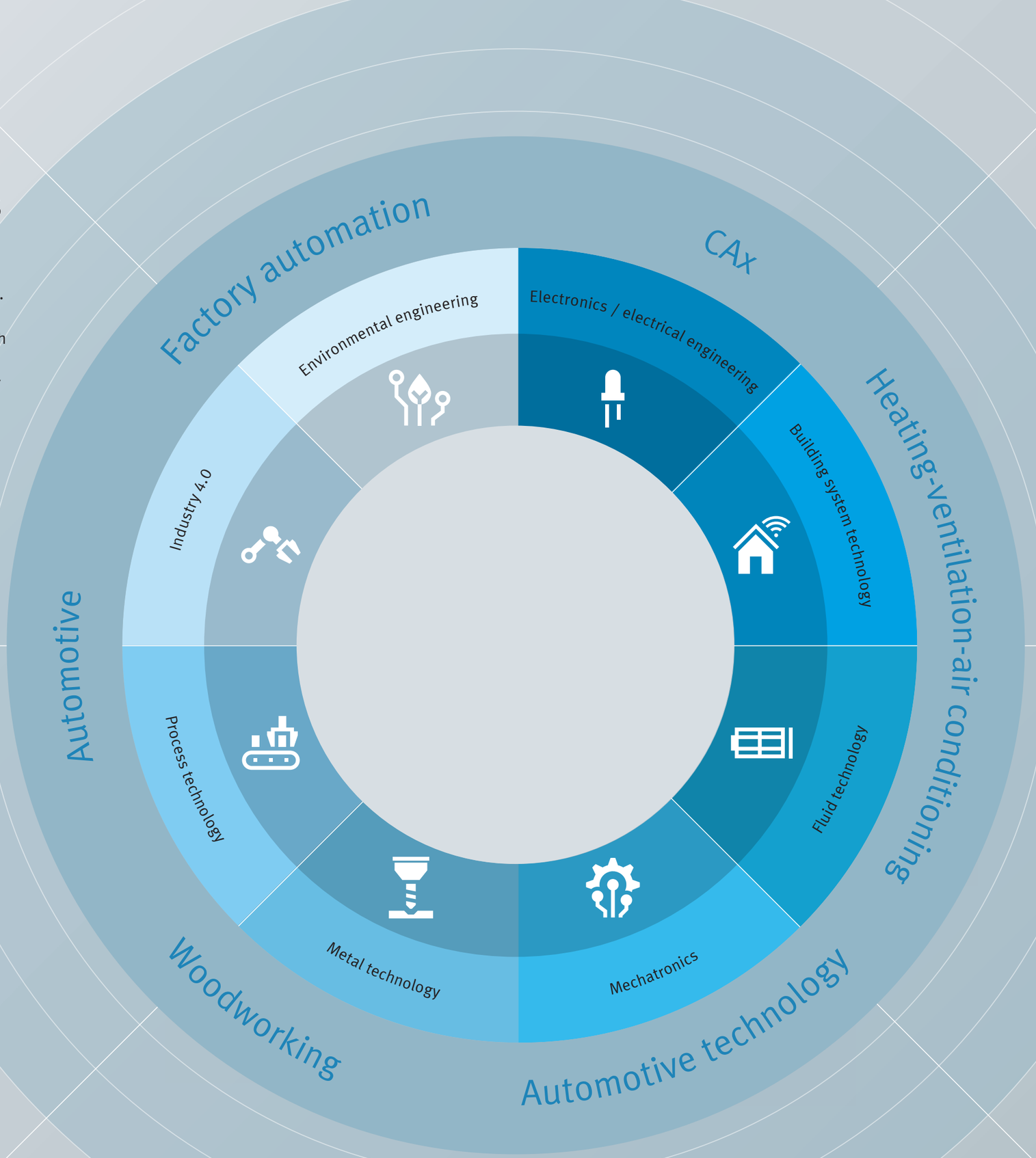
Our media supply

- Modular, flexible ceiling system for different room sizes
- Foldable, individually equipped energy lifts (energy, compressed air, data)
- Integrated lighting system
- Connection cabinet as a modular control center
- High economic efficiency thanks to a wide range of possible applications

Technology spectrum

Our room concepts

The multitude of technologies that we cover with our learning solutions is broad. On the following pages we highlight the central areas using various concepts. Each room contains complete, ready-to-use workplace systems that we implement for the respective technology.



Modularly connected

Multifunctional in electrical engineering

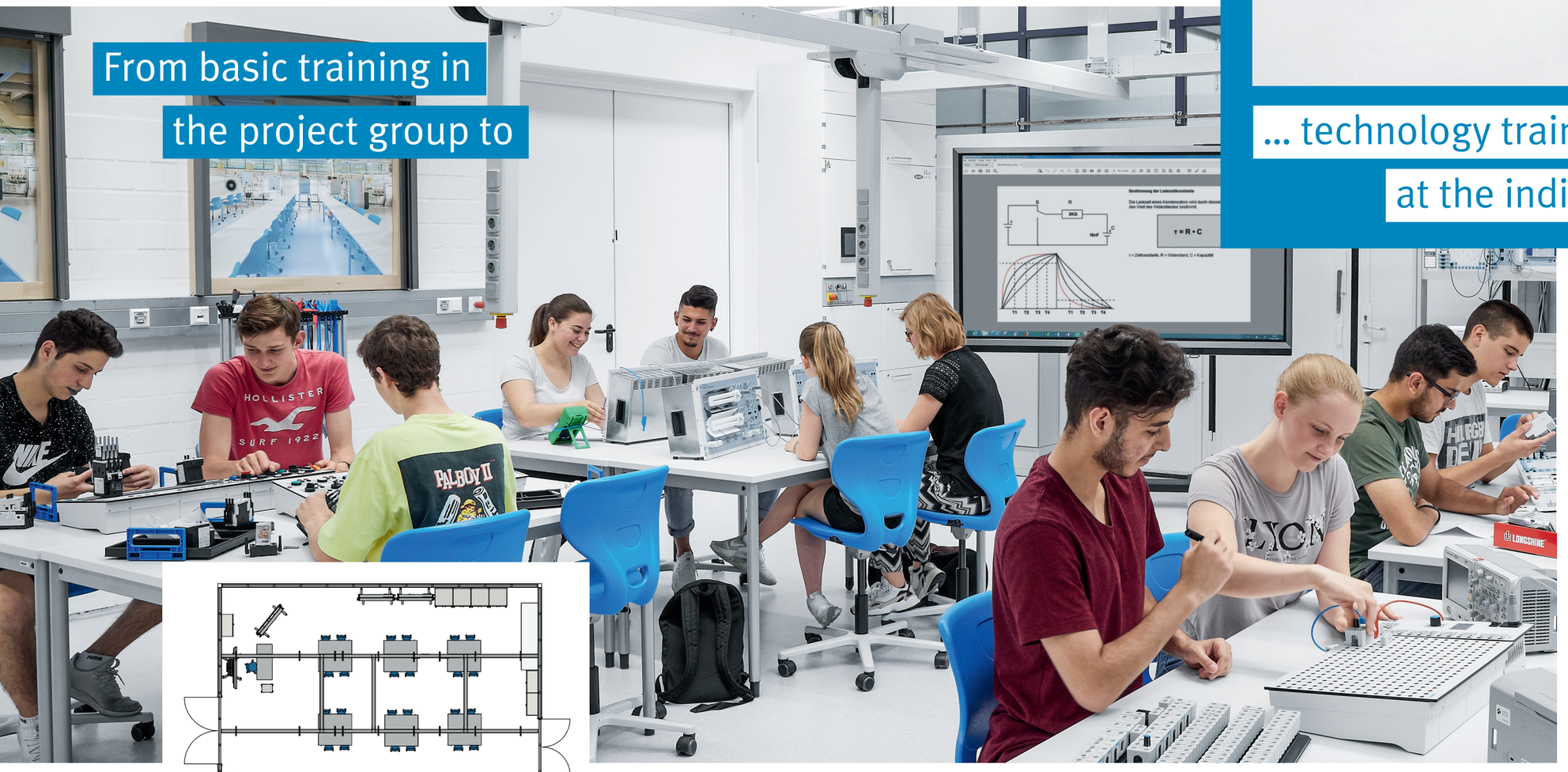
In electrical engineering, the focus is on electrical energy. With our learning system carriers, we therefore place great value on an ideal care of both three-phase and alternating current via the integrated energy channel. The training devices in DIN A4 format that are preferably used in electrical engineering training can also be easily incorporated in the learning system support, so that nothing stands in the way of technology training. If the lesson should take place as project work in groups, the A4 boards can be removed from the frames quickly and with just a few movements and placed on the tables.

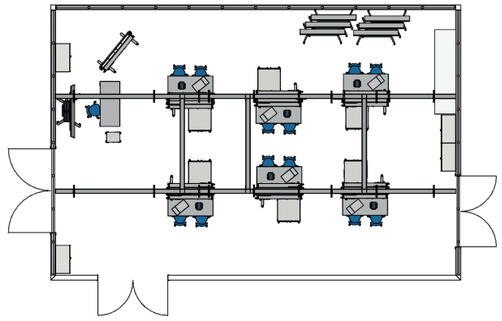
Converted in
a few minutes!



... technology training
at the individual workstation.

From basic training in
the project group to





Individually and modularly expandable at any time

Electrical engineering and electronics

Training in the basic disciplines is the first step in training in electrical engineering. All aspects of electrics and electronics including contact-based circuits and electric drives are important technologies that are taught in this laboratory. The laboratory equipment tailored to the technology packages includes the necessary power supply, mounting frames for experiment panels and all the necessary accessories.

1. Microcontroller
The learning system is ideal for training purposes in the areas of electronic systems and digital electronics, as well as for rapid prototyping.

2. Basic circuits of electrical installation technology
Mediation of planning, construction and checking of different basic circuits using the example of practical projects.

3. Basic electrical protection measures
Training package to raise awareness and communicate the dangers of electrical current.

4. Basics of contact-based circuits
The general functional principles are explained using examples and the basic knowledge of contact-based control technology is taught comprehensively.

5. FluidSIM®-E
Simulation and measurement in electrical engineering. The newly developed simulation core allows circuits to be simulated almost in real time. A range of integrated measuring devices support the evaluation of the simulation results.

6. Multimedia/creative zone



7. Connected learning
Connecting interactive courses and simulations with learning systems. Real measurement with virtual measuring devices enables a modern learning environment for the learners.



8. Basics of electrical engineering/electronics
The training package provides basic knowledge in the area of circuits, basic circuits as well as the function and behaviour of optoelectronic components.



9. Electrical drive technology
With the electrical teaching machines, almost all electrical circuits and drives occurring in industry, trade and households can be taught in a practical and training-oriented manner.



Smart Home & Co.

Building systems technology

Digitalization and networking in building systems technology present new challenges for teachers and learners. Different systems such as lighting, heating, renewable energies, blinds, alarm systems, etc. from different trades must communicate with each other and be controllable by installers, technicians and users. The building systems technology learning system is divided into various modules. Each of these topic modules makes it possible to select individual learning depths and forms a self-contained learning unit.

1. Network systems and protective measures
Possible hazards in the handling of electrical energy are examined and demonstrated by means of measurements.

2. Building automation with KNX
Dealing with bus systems for intelligent control of lighting and air conditioning.

3. Energy-efficient lighting technology
Different illuminants are compared in terms of their mode of operation, light generated, energy efficiency and area of application.

4. Small controllers
The learning system offers an introduction to the control and monitoring tasks in building system technology.

5. FluidSIM®-E
Simulation and measurement in electrical engineering. The newly developed simulation core allows circuits to be simulated almost in real time. A range of integrated measuring devices support the evaluation of the simulation results.

8. Wind/solar energy
Learners can be introduced to the basics of wind and solar energy production. The theoretical knowledge is consolidated with practical exercises.



6. Multimedia/creative zone

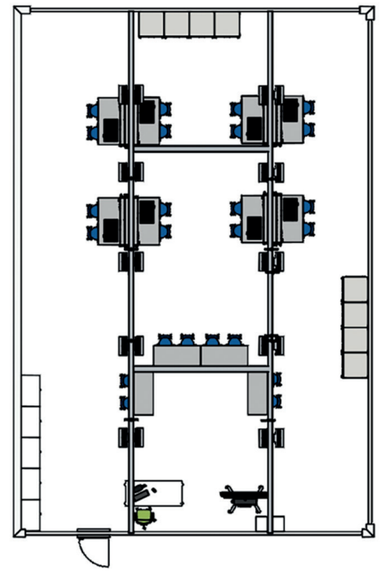
7. Building control systems
The HVAC Building Control learning system supports the instructor in teaching the fundamentals of modern control systems using commercially available components.

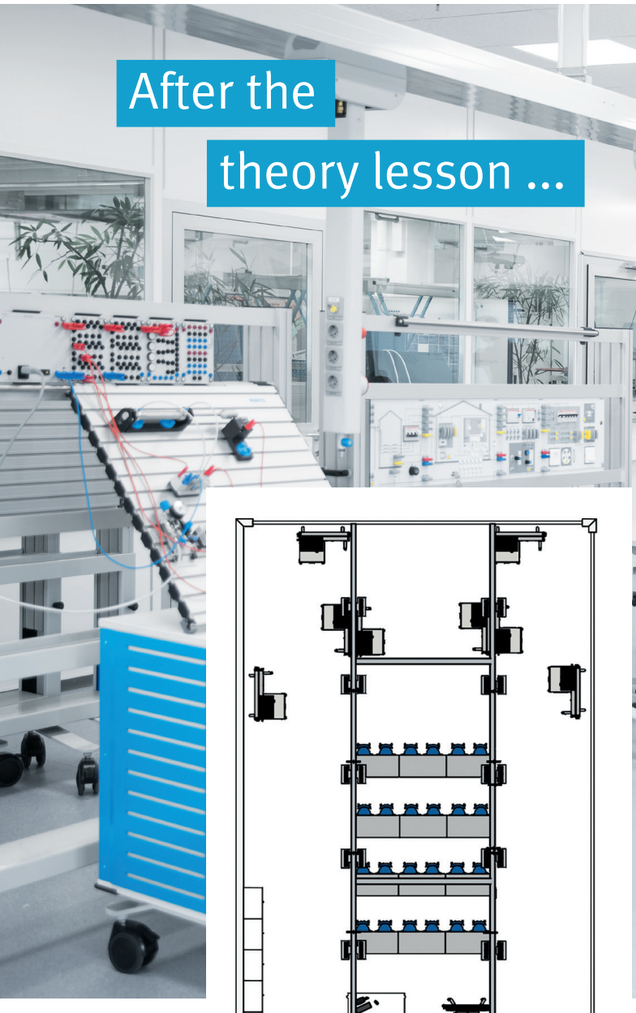
9. Charging infrastructure
The planning, installation, testing and troubleshooting of modern charging stations will be troubleshooting of modern charging stations.

Well supplied

Multifunctional in fluid technology

Compressed air is elementary for training in pneumatics. After the theoretical basics have been taught in frontal instruction, the flexible swivel arms of the ceiling system can be folded down for the practical exercises. Thanks to the integrated supply connections, compressed air is thus available in the entire room in the shortest possible time. The inclination-adjustable profile plate, onto which the training components can be simply attached using QuickFix, ensures ergonomic, varied work while sitting and standing.

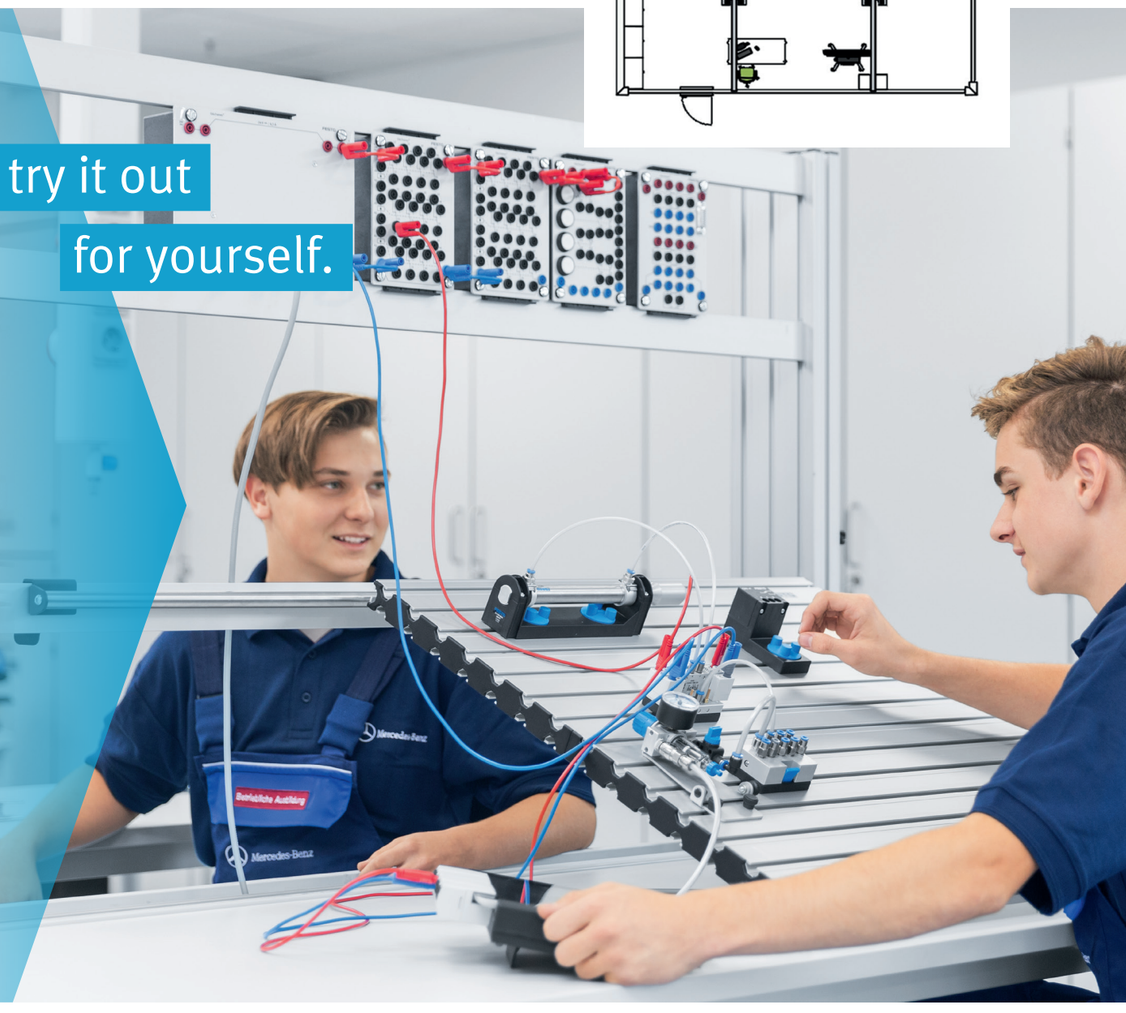




After the theory lesson ...

... try it out for yourself.





Individual learning phases through digitalization

Fluid power

With the experience gained from over 1000 fluid power seminars, the fundamentals in pneumatics and hydraulics can be successfully taught. The design of the laboratory and the selection of learning components and media enable self-learning phases with the fluid power learning programs, connected learning with Tec2Screen, circuit design and simulation with FluidSIM, practical implementation, functional testing and optimisation of the circuits in group work with the equipment sets.





1. Pneumatic control and drive technology
Pneumatic drives are set up, analysed and combined with different control systems and regulations.



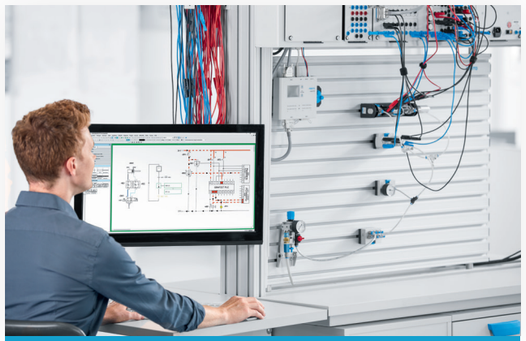
2. Hydraulic control and drive technology
Industrial and mobile hydraulics are practically built up on a compact mobile learning carrier and analysed in the learning process. In combination with suitable open and closed-loop control systems, the high energy density is used in a purpose-oriented manner.

3. Sensor technology
Sensors are the sensory organs of technology. Properties and limits of use can be learned here in practical experiments.

4. Programmable logic controllers
Control with PLC, networking, operation and visualization with HMI are combined with fluidic circuits. Control technology can thus be learned under practical conditions.

5. Digitalization in pneumatics
Mobile devices in maintenance support the troubleshooting. Daily business in the changed working environment of the industrial mechanic.

6. Connected Learning
The hurdle between theory and practice becomes lower. Tec2Screen® makes theory tangible.



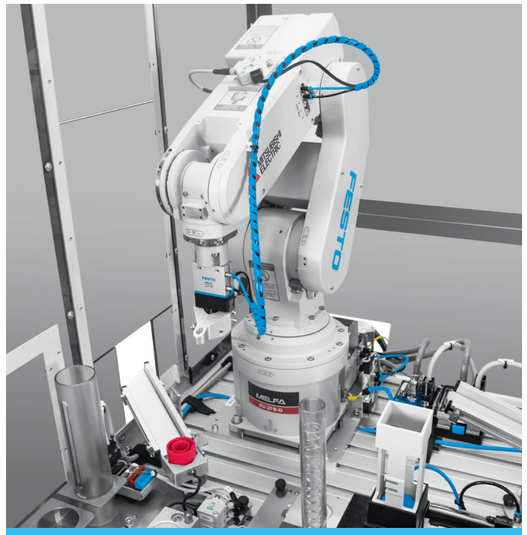
7. Simulation with FluidSIM®
The design of fluid power circuits and controls with GRAFCET is part of the basic knowledge of industrial metal and electrical professions. In FluidSIM® , project processing, technical documentation and systematic troubleshooting can also be trained.

Cross-technology training

Mechatronics/Automation

Skilled workers and technicians are responsible for the operation and maintenance of complex automated production facilities. In the process, all technologies must be seamlessly integrated. The learning stations in the automation technology laboratory form the basis for cross-technology training with the relevant problems from operational practice. The interaction of mechanics, pneumatics, electrics, control technology and communication interfaces can be analysed, understood and mastered - the best prerequisite for successful action in complex, networked systems.

1. Programmable logic controller
Commissioning and programming of individual mechatronic systems using simulation software, controllers or Tec2Screen®.



2. Robotics and simulation
Getting to know industrial robot systems as well as their handling, programming and optimization.
The appropriate simulation environment enables safe work in larger learning groups.



3. Intelligent sensor technology
Getting to know and using intelligent sensors to obtain production data and thus optimize processes and quality.

4. Drive technology
Electric drive technology in application: different drives and their control can be integrated into the mechatronic systems.

5. Linking of mechatronic subsystems
Joint construction of a production process consisting of autonomously operating individual stations..

6. Machine safety
Teaching of different protective measures in the handling of machines. The student learns how protective measures are integrated into machines step- by- step.



7. Connected Learning
Practical simulations enable programming exercises at different levels of complexity - new knowledge can be learned in a practical and safe way.

8. Simulation with FluidSIM®
Technical documentation and simulation are the tools of the trade for all M + E professions in the planning, assembly and troubleshooting of automated systems.

9. Multimedia/creative zone



Durable and flexible

Metal technology

In metalworking, the use of high-quality machines and tools is indispensable. We have experienced manufacturers at our side as partners who guarantee a consistently high quality standard. The metalworking laboratory is fully equipped with workbenches, machines and all necessary tools. We guarantee the highest precision, robust construction, simple operation, high safety standards, special durability and spare parts supply for all machines installed in the laboratory.

1. Welding technology
Welding is a central joining process in metalworking. Students can use this learning system to develop and expand their practical skills.

2. CAD/CAM
Designing drawings and programs for the production or measurement of workpieces.

3. Quality assurance
With this machine, the trainees are trained to measure and assess quality parameters such as the material quality or surface properties of a workpiece.

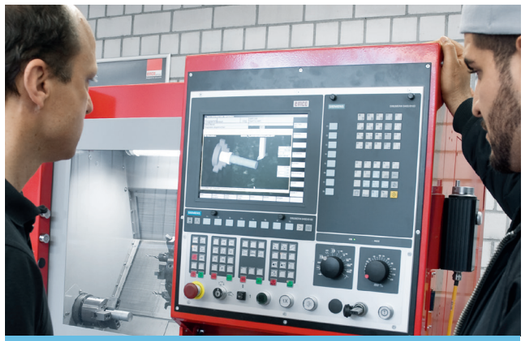
4. 3D printing
Rapid prototyping is the promising manufacturing process par excellence. To this end, the student is trained in the area of designing with CAD/CAM and manufacturing the designed component using 3D printing.

5. Manual material processing
Basic training in manual machining processes such as drilling, sawing, filing, etc.

6. Tool pre-setting
Students will acquire the ability to measure the tools used in the machines externally and to transmit the values to the machine.



7. Mechanical gear technology
With this learning system, students are trained in the essential installation and maintenance work on different types of gearboxes.



Machining of materials
With the conventional turning/milling machines, learners acquire basic knowledge of machining. The know-how about industrial manufacturing is taught with CNC turning/milling machines.

Rotate

8. Conventional | **9. CNC**

Milling

10. Conventional | **11. CNC**

12. Drilling



Measure - Control - Regulate

Process Technology

Current trends of the process industry include: changeability of production plants, personalised products, fluctuating production volumes, maximum availability, and digitalisation of all business processes. The Process Technology Room is designed to take the pressure off teachers and encourage students to learn and act independently. Many aspects of process technology are represented in hardware, software and teachware. The learning system aims to depict the common aspects of process technology with real-world application. Measurement and control of levels, flows, pressures and temperatures almost always play a role in monitoring a predetermined recipe of a manufacturing process



1. Introduction to process and control engineering
The project construction kit is designed on a table scale and serves to understand mechatronic plant construction and to learn the basics of measurement and control.

2. Process industry controlled systems
The learning system with different control sections teaches in 4 stations the filtering, mixing, tempering and filling of liquids in a realistic sequence.

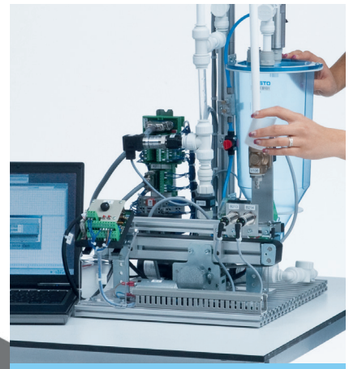
3. Multimedia/Creative Zone

4. Bulk material technology
This learning system teaches learners how to transport bulk materials gently and energy-efficiently, how to store them and how to dose them accurately.

5. Process control
The operation and monitoring of process plants usually takes place in control rooms. Our learning systems, on the other hand, convey the functionality of process control systems with a high degree of transparency.



6. FluidLab®-PA
Software-based teaching of the fundamentals of control engineering. Different controllers can be parameterized and measurement curves recorded with a click.



7. Digitalized business processes
Using a bottling process with batch size 1, the learner is given an insight into the world of IoT.



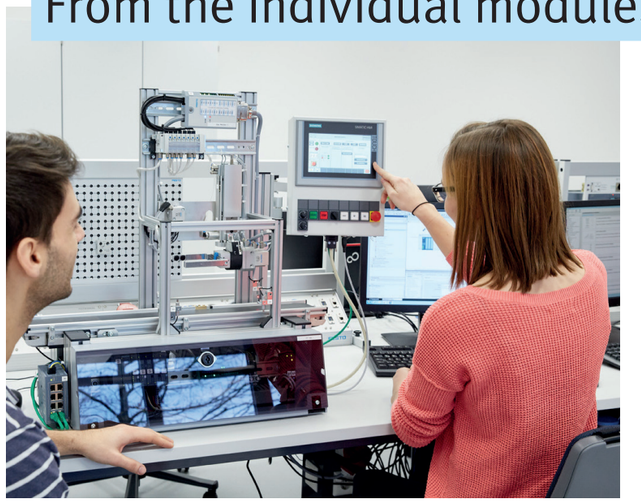
8. Compact process technology
The Compact Workstation is well suited to teach students measurement, control and regulation in the smallest of spaces with various controlled systems.

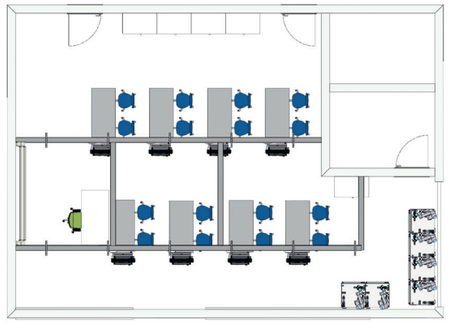
Our multifunctional room design

Multifunctional in Industry 4.0

In the field of Industry 4.0, it is important to introduce learners to the complex subject matter step- by-step. Our Cyber-Physical Learning Factory is therefore designed as an integrated learning system. Starting with the project workstation for the basics of PLC programming, through the construction of a small plant with several stations, to the Smart Factory, all modules and pallets can be used throughout. Our multifunctional room equipment makes it possible to implement this continuous learning path in one and the same room. The different learning scenarios can be implemented one after the other or also in parallel in the room.

From the individual module...





... to the complete I4.0 learning factory.



Convertible from small to large

Industry 4.0

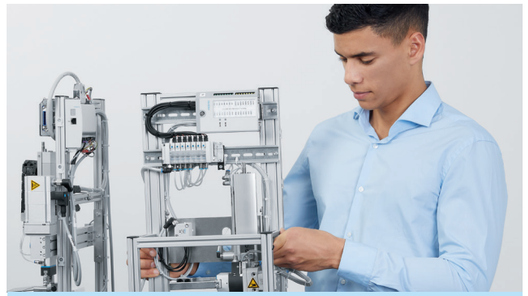
Flexibility, agility, adaptability and efficiency - these are the demands on the production of the future. For a successful change in education and training, the Industry 4.0 lab contains everything from individual workstations to complete learning factories. Based on the classic training content of mechatronics, learners are gradually introduced to Industry 4.0-relevant content up to the Cyber-Physical Factory. Since learning fields and needs are constantly changing, the lab is modular and flexible and can be adapted and supplemented to individual requirements at any time.

1. Identification
The basis of modern production with batch size 1 is the identification of components. For this reason, learners can learn about 4-bit and RFID using practical examples.



2. PLC programming
Commissioning and programming of individual mechatronic systems using simulation software, controllers or Tec2Screen®.

3. Learning factory
Individual production with batch size 1, the individual transfer lines can be converted to a carousel.
The production steps are controlled with the help of the integrated RFID tags. The use of an MES system and thus the creation of part numbers, work plans and orders are also possible.



4. MES
Control of cyber-physical systems for the production of individual products. The learners gain insight into the networking of production processes, individual production and analysis of production data.

5. Robotics
Industrial and collaborative robots promote the automated and individualized production process of the future.

6. Customized manufacturing
Production of workpieces in batch size 1 is supported by manufacturing processes such as 3D printing and CNC machining. The networking of the individual plant components with an MES is central learning content.

7. Data security and networking
Due to increasing digitalization, training content in the area of networking and data security is becoming more and more relevant. Learners can carry out practical exercises in guided teaching scenarios, from the basics to structured networks and secure remote access.

8. Energy monitoring
Measure, record and evaluate energy consumption.

9. Artificial Intelligence/Machine Learning
Practical introduction to the current topic of machine learning. By means of a camera module, components are detected and differentiated, and their anomalies and quality are identified and measured.



10. Simulation and digital image
The simulation environment enables both exercises in PLC programming at individual stations in the learning factory and the setup of networked plants and their control from the MES system.

11. Creative Island

Modular learning systems for water, energy and resource efficiency

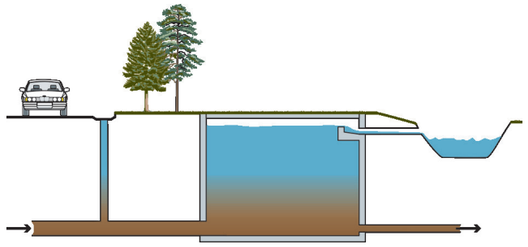
Environmental Technology

Environmental protection is not just the responsibility of governments, regional authorities and companies, but of every individual. One of the most important social tasks is to supply the population with water and energy and to use material cycles in an environmentally friendly way. Clever and sustainably designed environmental technology can only be developed, built and operated by well-trained people. The learning systems offered are designed to give learners an idea of the big picture at an early stage. This fosters motivation to delve into the necessary details in depth and knowledge for optimizing systems. Our space planning aims to: Arouse curiosity, promote knowledge, learn to act and develop new things with creativity!





1. Drinking water, industrial water, sewage
The water cycle from source to use to wastewater transport and treatment is delivered in concrete, comprehensible technology.



2. Environmental laboratory
The learners have access to extensive digital information and animations for familiarization with water technology. This makes learning multimedia and independent of lesson times.



3. Occupational, plant and IT security
Environmental plants often belong to the so-called critical infrastructure (KRITIS). A learning system in combination with an extension on the topic of IT security offers an interdisciplinary trainingafield for plant construction, operation, maintenance and optimization.

4. Pneumatics in water management
The learners are taught the simple and efficient drive of process valves via pneumatics and the functionality of emergency operation using compressed air storage after a power failure.

5. Energy and resource efficiency
Analysis of processes by means of measurement technology and reaction to possible disturbance variables with a suitable controller strategy. Many interdependencies need to be considered in order to get closer to the goal of better climate efficiency.

6. Charging infrastructure
The electric vehicle charging station provides hands-on training in the planning, installation, testing and troubleshooting of modern charging stations.

7. Building Control Systems
The HVAC building system controls learning system supports the instructor in teaching the fundamentals of modern controls using commercially available components.

8. Multimedia/creative zone

9. Wind/Solar Energy
Learners can be introduced to the basics of wind and solar energy production. The theoretical knowledge is consolidated with practical exercises.

One room - several technologies

Project example

The situation in vocational schools and training centres is usually similar: The number of available rooms is limited and the number of learners is too high in relation to this. The challenge is to accommodate learners of several training years and different professions in the premises. However, the rigid and inflexible furniture available in schools makes this almost impossible. Using a real-life example, we will show you how to achieve an ideal multifunctional solution with the appropriate equipment.

Room size	12 m x 8 m
Learners	16
Teacher	1
Technology	Electrical engineering and fluid power
Furnishing	
Energy supply via the ceiling system	
Frames	8
Mobile container	8
Mobile and foldable tables	8
Swivel chairs	16

„It always seems impossible until it's done.“

Nelson Mandela

Same room
Same furniture
Two technologies



From lounge to centre of excellence

The implementation

In accordance with the mission statement of the State Vocational School Lauingen „We want to educate our students to become responsible and respected members of our society“, the idea of designing an integrated specialist room was born at the beginning of 2018.
Headmaster Gottfried Göppel himself took on the project at the time and lobbied for the provision of appropriate funds in various committees.

It is not least thanks to the commitment of the teachers that a multifunctional learning space has been created which, thanks to its flexibility, can be used in a variety of ways. The main objective was and is to bring the digitized world closer to young people and to enable them to face the challenges that come with it.

The interaction between man and machine was the focus of the planning work. Theoretical and practical areas were to be equally implementable and thus enable experimental, action-oriented teaching for the students. A modern and functional learning environment was created to strengthen the professional competence of the participants, taking into account the digital transformation in all professional fields.

STAATLICHE BERUFSSCHULE LAUINGEN
MIT BERUFSFACHSCHULE FÜR TECHNISCHE ASSISTENTEN FÜR INFORMATIK















„The installation of a ceiling system and the use of a flexible furniture range allow the room to be converted in a very short time and also to teach different subject areas in the same room.“-

Gottfried Göppel, Headmaster BS Lauingen

From craft to industry 4.0

References and impressions

We advise and equip other numerous customers in the industry and in the technical-commercial education sector.

Mechatronics School Winterthur
With an Industry 4.0 learning factory from Festo Didactic, the Mechatronik Schule Winterthur teaches its trainees mechatronics and Industry 4.0. The decisive factor in the decision was the overall concept that we were able to offer the customer around the very industry-oriented system and the didactic additions. „Multifunctional“ and „flexible“ were the keywords that attracted particular interest from the headmaster and teachers.



Friedrich-Ebert-Schule Esslingen







Multifunction room at the Friedrich-Ebert-Schule Esslingen
Digitalization is also making its way into the skilled trades and the trades are becoming more and more interconnected. In order to meet this change already in the training, the Friedrich-Ebert-Schule has set up a Multilabor Handwerk 4.0. The room offers new and flexible forms of learning, as the students can acquire their knowledge individually at laboratory workstations, in project work or self-learning phases, depending on their learning level and trade. Future expansion options were already considered when the laboratory was set up.







MSW Mechatronik Schule Winterthur

Multifunctional learning rooms Fluid Power, Electrical Engineering, Mechatronics, Industry 4.0 and Tec2Screen.



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Multifunctional learning rooms Industry 4.0, fluid technology, electrical engineering in the training centre of the company Freudenberg, Weinheim.



IHK Industrie- und Handelskammer Ostwürttemberg







Multifunctional learning space Industry 4.0 CP Lab at the vocational school Farmsen BS 19, Hamburg.

BS19
BERUFLICHE SCHULE FARMSEN
MEDIEN • TECHNIK







Daimler



Multifunctional learning rooms for fluid technology and Industry 4.0 at the training centre of Daimler AG Stuttgart.

Festo Didactic SE

Rechbergstrasse 3
73770 Denkendorf
T +49 711 34 67-0
F +49 711 347 54 88 500
did@festo.com
www.festo.com

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