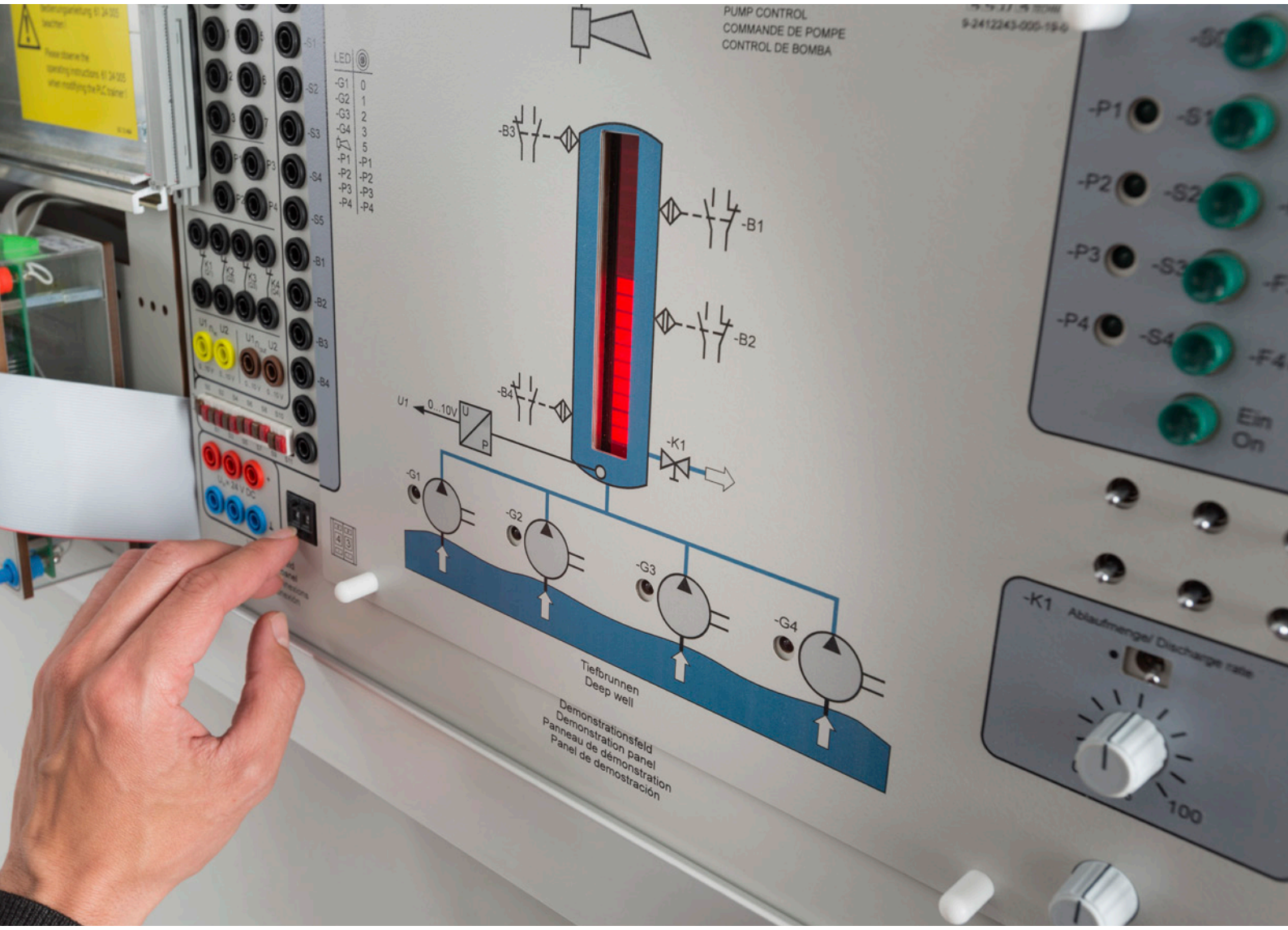
ELWE® TECHNIK

HIGHLIGHTS



TRAINING SYSTEMS FOR VOCATIONAL AND TECHNICAL EDUCATION

LD DIDACTIC

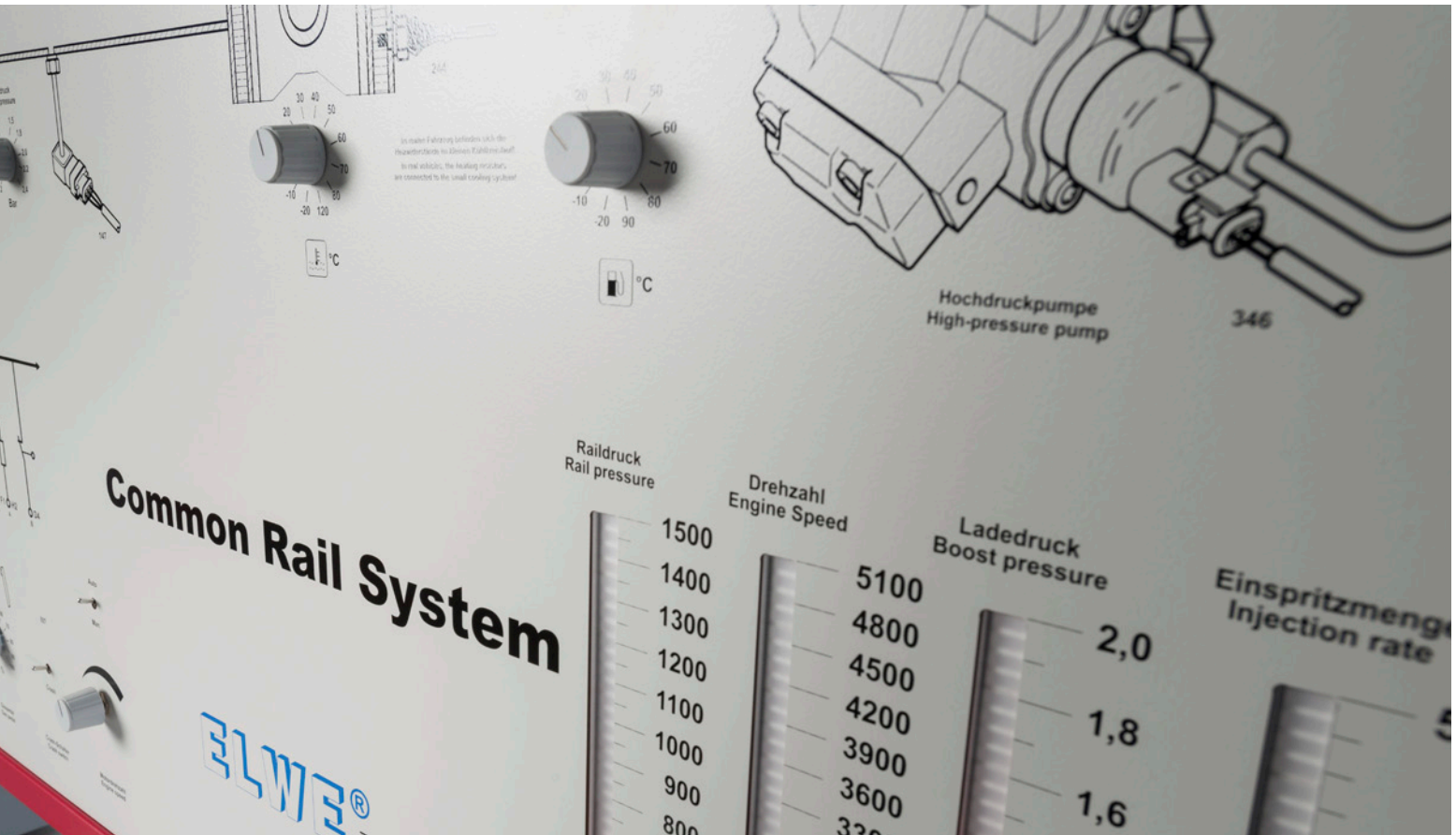
ELWE® TECHNIK

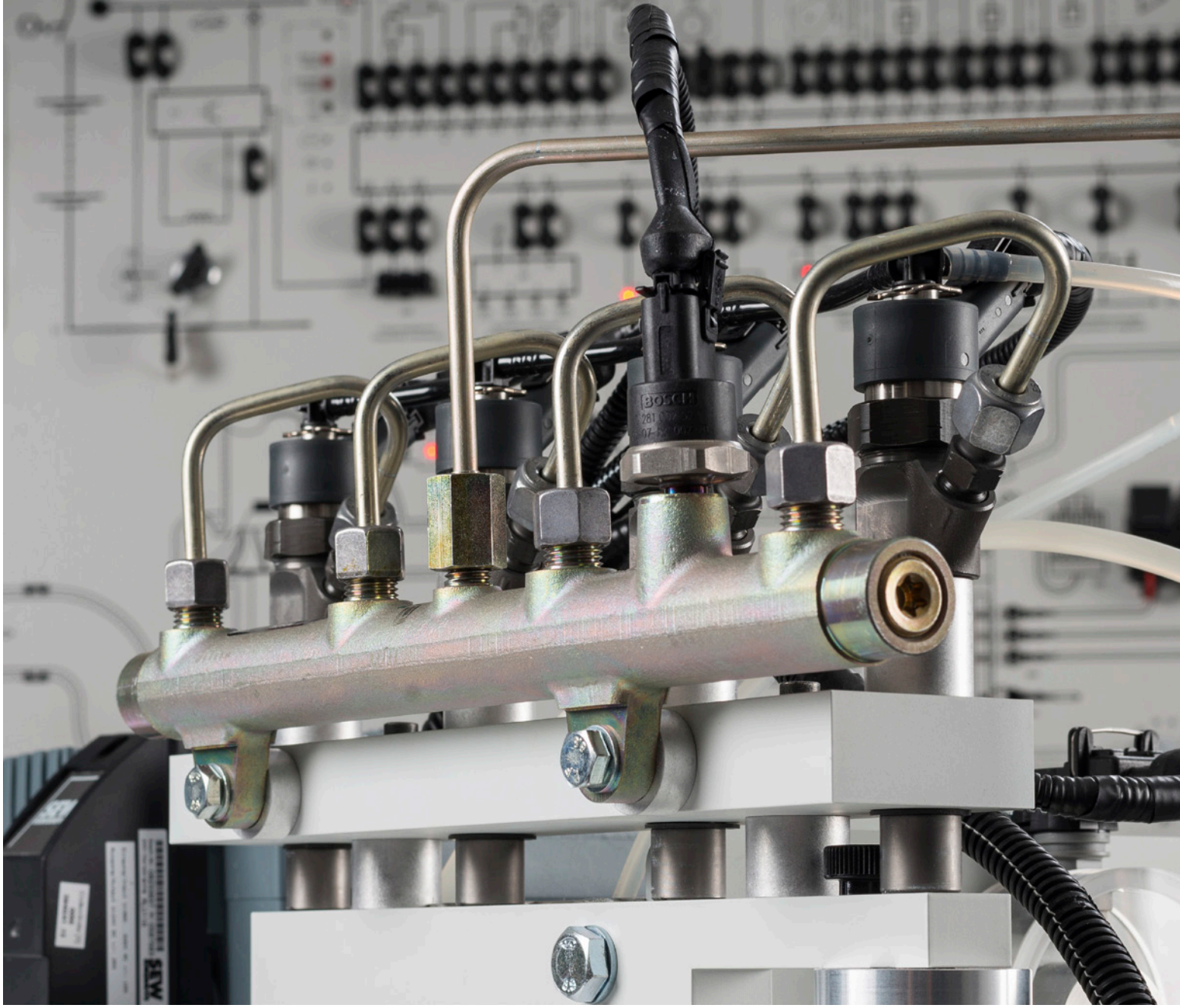
INNOVATIVE INDUSTRIAL

ELWE Technik products are known both for high quality and industrially relevant educational content. For decades ELWE Technik has represented the very best in German technical training systems.

In 2013 LD DIDACTIC group acquired ELWE Technik. Their products are now managed by one of the world leaders in high-quality training systems for science and technology. ELWE Technik is the perfect complement to the existing LD DIDACTIC brands, LEYBOLD and FEEDBACK, in both vocational and advanced technical education. For the topics of electrical engineering and automotive technology as well as for renewable energy technology the ELWE Technik portfolio offers comprehensive solutions.

DIDACTICALLY STRONG





ELWE Technik products are made and tested in Germany at our facilities in Hürth and Urbach. These products focus on high-quality innovative solutions that help you optimise your educational systems.

This brochure offers an insight into the world of ELWE Technik. Detailed information on the individual products and equipment can be found on the internet at WWW.ELWE-TECHNOLOGY.COM

Technical consultants are always available.
Please contact our customer centre.

MODULAR

ELECTRICS ELECTRONICS

BUILDING MANAGEMENT TECHNOLOGY

ENERGY TECHNOLOGY

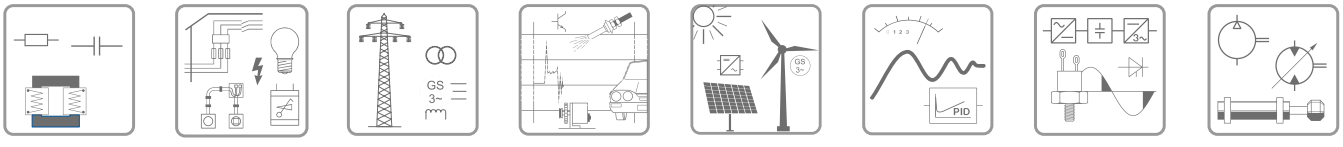
AUTOMOTIVE TECHNOLOGY

RENEWABLE ENERGY

MECHATRONICS AUTOMATION

DRIVE AND CONTROL TECHNOLOGY

HYDRAULICS



ELWE® TECHNIK

FOR ANY LEVEL OF EDUCATION

ELWE Technik offers a wide range of products on various topics, ranging from technical fundamentals up to the highest level. ELWE Technik training systems are designed to meet the needs of:

VOCATIONAL COLLEGES
TECHNICAL COLLEGES
ON-THE-JOB TRAINING
UNIVERSITY DEGREES

Following please find the areas and topics covered by ELWE Technik training systems. These all follow modern industrial practice. More detailed information on individual solutions are available at:

WWW.ELWE-TECHNOLOGY.COM

The combined product ranges from ELWE Technik, FEEDBACK and LEYBOLD provide a very wide range of training systems and are relevant to all fields of technical education.

Our technical agents can give you individual help for your system requirements.

AUTOMOTIVE TECHNOLOGY

BUS SYSTEMS
SENSORS AND ACTUATORS
AIR CONDITIONING
SAFETY FEATURES
ENGINE MANAGEMENT
LIGHTING SYSTEMS
DRIVE TRAIN, TRANSMISSIONS AND STEERING

ELECTRICAL ENGINEERING

ELECTRONIC FUNDAMENTALS

CIRCUITRY AND DIGITAL ELECTRONICS

ANALOG TECHNOLOGY

DIGITAL TECHNOLOGY

OPEN AND CLOSED-LOOP CONTROL

DRIVE AND POWER ELECTRONICS

POWER SUPPLY TECHNOLOGY

AUTOMATION

WIRING INSTALLATION AND BUILDING MANAGEMENT

RENEWABLE ENERGY

PHOTOVOLTAICS

POWER FROM WIND AND WATER

GENERATION AND DISTRIBUTION OF ENERGY

ENERGY EFFICIENCY AND METERING

PRACTICALLY

DIDACTICALLY PROVEN

All training systems include full experiment instructions. This simplifies preparation, saves time and enables easy monitoring of experiment outcome.

Use of real industrial parts ensures that the ELWE Technik training systems mirror modern industrial practice. Mimic diagrams and circuit symbols are printed on the panels. Used together with the experiment instructions, students are able to fully comprehend the most complex circuits.
Safety features for all experiments and components are rigorously applied.

TRANSPARENT

Training panels with easy-to-read circuit symbols and diagrams.

DETAILED INFORMATION IS AVAILABLE AT
WWW.ELWE-TECHNOLOGY.COM

OVERVIEW OF TOPICS

Below please find an overview of the ELWE Technik portfolio. We have compiled some highlights for you, which we would like to present in detail on the with P.xx marked pages. The complete product range is available on the webpage at WWW.ELWE-TECHNOLOGY.COM or at WWW.LD-DIDACTIC.COM.

AUTOMOTIVE TECHNOLOGY

A1.2.1.1
U 1/6K Basics of electrics/ electronics for automotive technicians
P.10

A1.2.2.1
Signalling systems and main lights

A1.2.2.2
Ignition systems

AUTOMOTIVE TECHNOLOGY

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Starting aid for diesel engines

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Three-phase alternator trainer, 14 V

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P.12

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Climatronic

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"CAN-Bus-Multi"

RENEWABLE ENERGY

R1.2.1.1
STE Wind Basic

R1.2.2.1
STE Solar Basic

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FUNDAMENTALS

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Photovoltaic system - grid-connected, basic equipment set
P.14

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Photovoltaic system - isolated network, basic equipment set

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Mobile photovoltaic system, basic equipment set

SOLAR AND PHOTOVOLTAIC

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Wind tunnel with accessories

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P.15

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Mobile Wind Power Plan, full equipment set

WIND AND WATER POWER

R4.1.3.1
Battery Simulator

R4.2.1.1
Recording of characteristics of a PEM fuel cell stack

R4.2.1.2
Fuel Cell workstation

ENERGY STORAGE

R5.1.1.1
Overhead transmission lines and electric transmission cables, full equipment set

R5.1.1.3
Double busbar System

R5.1.3.1
Training System "Supply of a big city"

DISTRIBUTION GRIDS INFRASTRUCTURE

OVERVIEW OF TOPICS

ELECTRICAL ENGINEERING

FUNDAMENTALS OF ELECTRICAL ENGINEERING / ELECTRONICS

- **T2.1.1** U 1 Fundamentals of electrical engineering, SB System, full equipment set P.16
- **T6.1.1.1** U 6 Fundamentals of electronics, SB System, full equipment set P.17
- **T6.1.2.2** Digital trainer, full equipment set
- **E2.4.1.3** U 10 Power electronics, full equipment set, module system

DRIVE TECHNOLOGY

- **E2.5.3.8** TG 10.73 Frequency converter with servo drive, with rotary drive
- **E2.5.3.9** TG 10.75 Frequency converter U=f(f) / FO, 1000 W
- **E2.5.3.10** Efficiency machine as electrically controlled drive P.19
- **E2.7.1.0** Transformers 0.3
- **E2.8.2.0** DC machines 1.0
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- **T4.2.1.6** TG 4.140 Lighting, panel system
- **T4.2.1.16** U 4.100 Installation circuits with switches, module system P.20
- **T4.2.1.17** U 4.110 Installation circuits with push buttons, module system, supplementary equipment set
- **T4.2.1.18** U 4.115 Bell system and door opener, module system, supplementary equipment set
- **T4.3.6** U 0100 Protection circuits VDE 0100, module system, full equipment set
- **T4.3.7** Fault simulator "Protection for safety"
- **T4.3.8** Experimental case on electrical engineering measures
- **T4.3.9** Fault simulator for installation circuits

AUTOMATION TECHNOLOGY

- **T11.3.1.1** TG 17.230 Inductive instrument transformers, panel system
- **T11.3.2.1** TG 17.260 Protective relays, panel system
- **T11.4.1.1** TG 17.280 Reactive power compensation, panel system
- **T11.4.2.1** TG 17.270 Kilowatt-hour meters, panel system
- **T9.5.1.1** PROFIBUS-Master with Siemens S7-300, panel system, full equipment set
- **T9.5.1.5** S7-300 Trainer with CPU 315-DP, 4-mm safety sockets
- **T9.5.1.10** S7-300 Trainer CPU 314C-2DP with ASIMA
- **T9.5.1.11** LOGO! Trainer 24 V DC, 8 DI, 4 DO-Relais, 2 AI and LOGO! Main supply unit P.25

CONTROL TECHNOLOGY

- **T9.5.1.21** S7-300 Trainer/ CPU 314C-2DP, incl. PROFIBUS-Master
- **T9.5.1.28** Motor and drive and PROFIBUS-DP, full equipment set
- **T9.5.2.1** 2 x MCS Experiments for beginners with PROFIBUS-DP, full equipment set P.28
- **T9.5.2.2** Motor and gearbox with PROFIBUS-DP, full equipment set
- **T9.5.3.4** Electro-hydraulics with transparent components for 50-mm grid
- **T9.5.3.5** Electrical basic circuits for hydraulics with transparent components
- **E6.2.4.1** AMIRA: Three-tank-system P.32
- **E6.2.4.2** AMIRA: One-tank-system
- **E6.2.4.8** AMIRA: Loading Bridge
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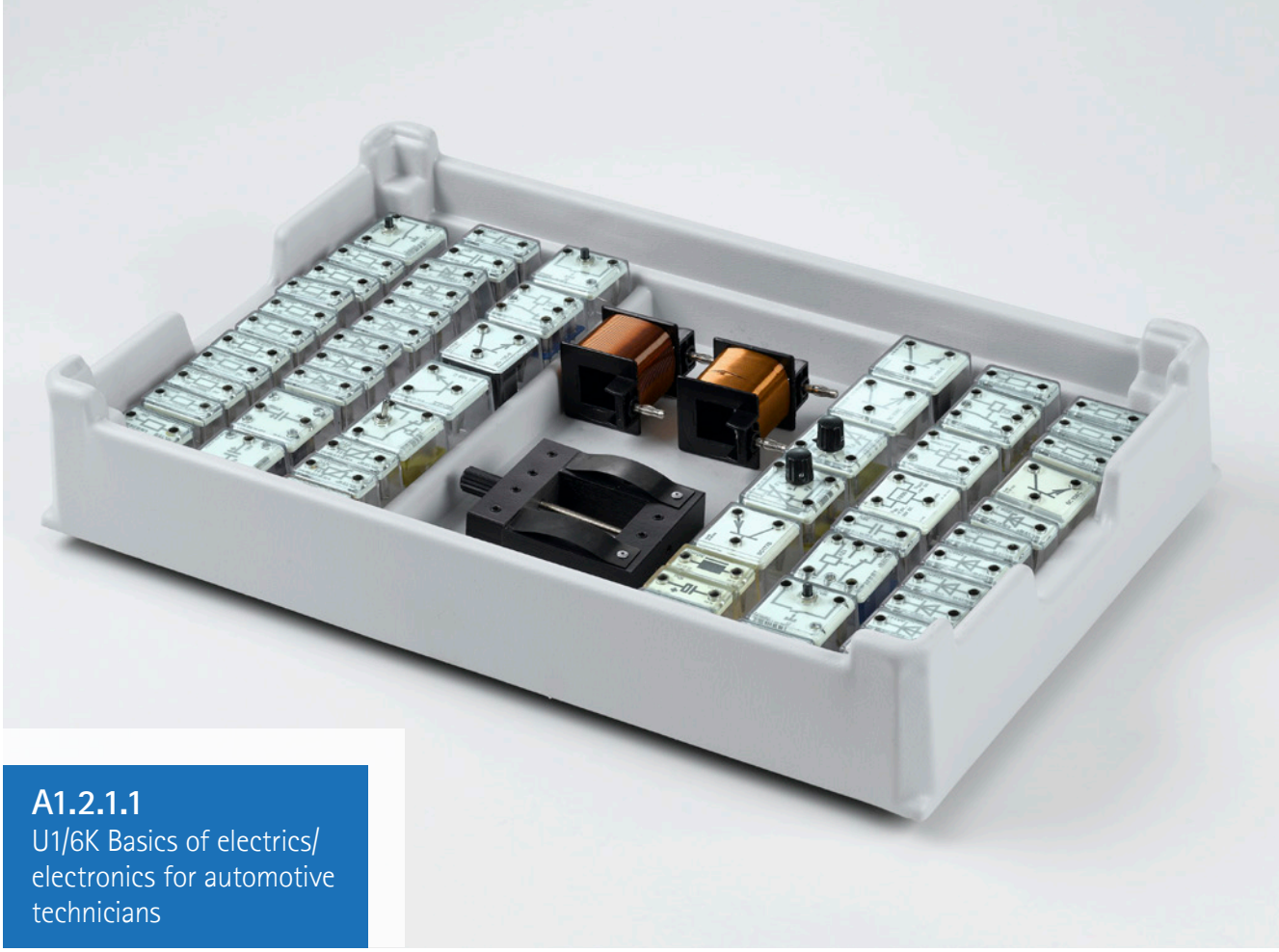
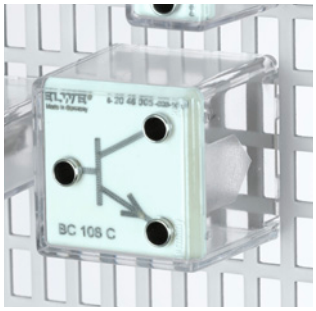
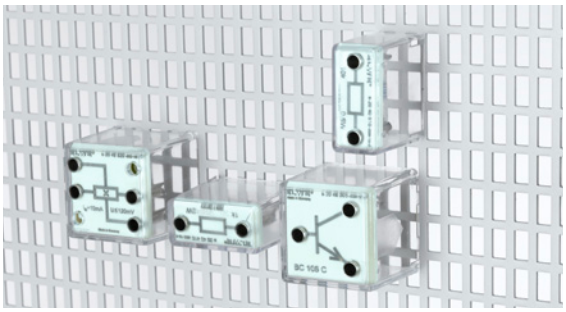
- **E6.2.4.10** AMIRA: Airstream and Temperature Control

E2.4.2.3 TG 10.50 Line-commutated converters, full equipment set	**E2.4.3.4** TG 10.40 DC chopper, panel system, full equipment set P.18	**E2.4.3.5** TG 10.30 Switching power supply, full equipment set	**E2.5.3.6** Principles frequency converter, Compact system	**E2.5.3.7** TG 10.71 Frequency converter 300 W, full equipment set
E2.7.2.0 DC machines 0.3	**E2.7.3.0** AC machines 0.3	**E2.7.4.0** Asynchronous machines 0.3	**E2.7.5.0** Synchronous machines 0.3	**E2.8.1.0** Transformers 1.0 DC machine 1000 W
T4.2.1.1 TG 4.100 Installation circuits with switches, panel system	**T4.2.1.2** TG 4.110 Installation system with push buttons, supplementary equipment set	**T4.2.1.3** TG 4.115 Bell system and door opener, supplementary equipment set	**T4.2.1.4** TG 4.120 Switching and dimming filament and halogen lamps, supplementary equipment set	**T4.2.1.5** TG 4.130 Installation circuits with fluorescent lamps, panel system
T4.2.1.19 U 4.120 Switching and dimming filament and halogen lamps, module system, supplementary equipment set	**T4.2.1.20** U 4.130 Installation circuits with fluorescent lamps, module system P.21	**T4.2.1.21** U 4.140 Installation circuits with fluorescent lamps, module system	**T4.2.1.31** Wall for concealed installation with accessories and tools	**T4.3.5** TG 0100 Protection circuits VDE 0100, panel system, full equipment set
T4.3.10 Fault simulator VDE 0701	**T11.1.1.1** TG 17.210 Synchronous generator, 1000 W	**T11.2.1.1** TG 17.220 Transformers and reactors, panel system	**T11.2.2.1** TG 17.250 Overhead transmission lines and electric transmission cables, panel system	**T11.2.5.1** TG 17.140 Double busbar system P.22
T11.5.1 Training system "Supply of a big city"	**T9.5.0.1** Contactor circuits, 300 W, 24 V, module system, full equipment set	**T9.5.0.2** Contactor circuits, 300 W, 230 V, module system, full equipment set	**T9.5.0.3** Contactor circuits 1000 W, 230 V panel system	**T9.5.0.4** Fault simulator for contactor circuits, 300 W P.24
T9.5.1.13 LOGO!-Trainer 230 V AC, 8 DI, 4 DO-Relais, supplementary equipment set	**T9.5.1.15** Literature, Software, accessories for LOGO!	**T9.5.1.16** LOGO! Trainer 24 V DC with ASIMA	**T9.5.1.19** ASIMA system simulator, full equipment set P.26	**T9.5.1.20** S7-300 Trainer/ CPU 314C-2DP, incl. ASI-Master CP343-2
T9.5.2.4 4 x MCS Experiments for PROFIBUS-DP, full equipment set P.28	**T9.5.2.6** 8 x MCS Experiments for PROFIBUS-DP, full equipment set P.28	**T9.5.3.1** Hydraulics with transparent components, Basic level P.30	**T9.5.3.2** Hydraulics with transparent components, 50-mm grid, basic level	**T9.5.3.3** Secondary level with transparent components for 50-mm grid
E6.2.4.3 AMIRA: Rotational speed control	**E6.2.4.4** AMIRA: Magnetic suspension P.33	**E6.2.4.5** AMIRA: Ball and beam P.34	**E6.2.4.6** AMIRA: Position control	**E6.2.4.7** AMIRA: Inverted Pendulum P.35



A1.2.1.1
U1/6K Basics of electrics/ electronics for automotive technicians





Specific equipment for automotive engineering has been developed for basic training in the student experiment. This explains the electronics in a car using practical examples.

LEARNING OBJECTIVES:

- Understanding and applying electrical and electronic basic circuits
- Measuring electrical variables
- Analysis of circuits

The ELWE Technik 6K is a supplementary set to the subject "Principles of Electrical Engineering for Automotive technicians" and addresses the subject electronics. The supplementary set provides you with all required components and devices to enable you to carry out the experiments described in the experiment instructions. This collection contains SB elements for grid plug-in panels.

LEARNING METHOD:

This set is designed for student experiments. Imparting knowledge based on the associated literature and practising how to operate multimeters.

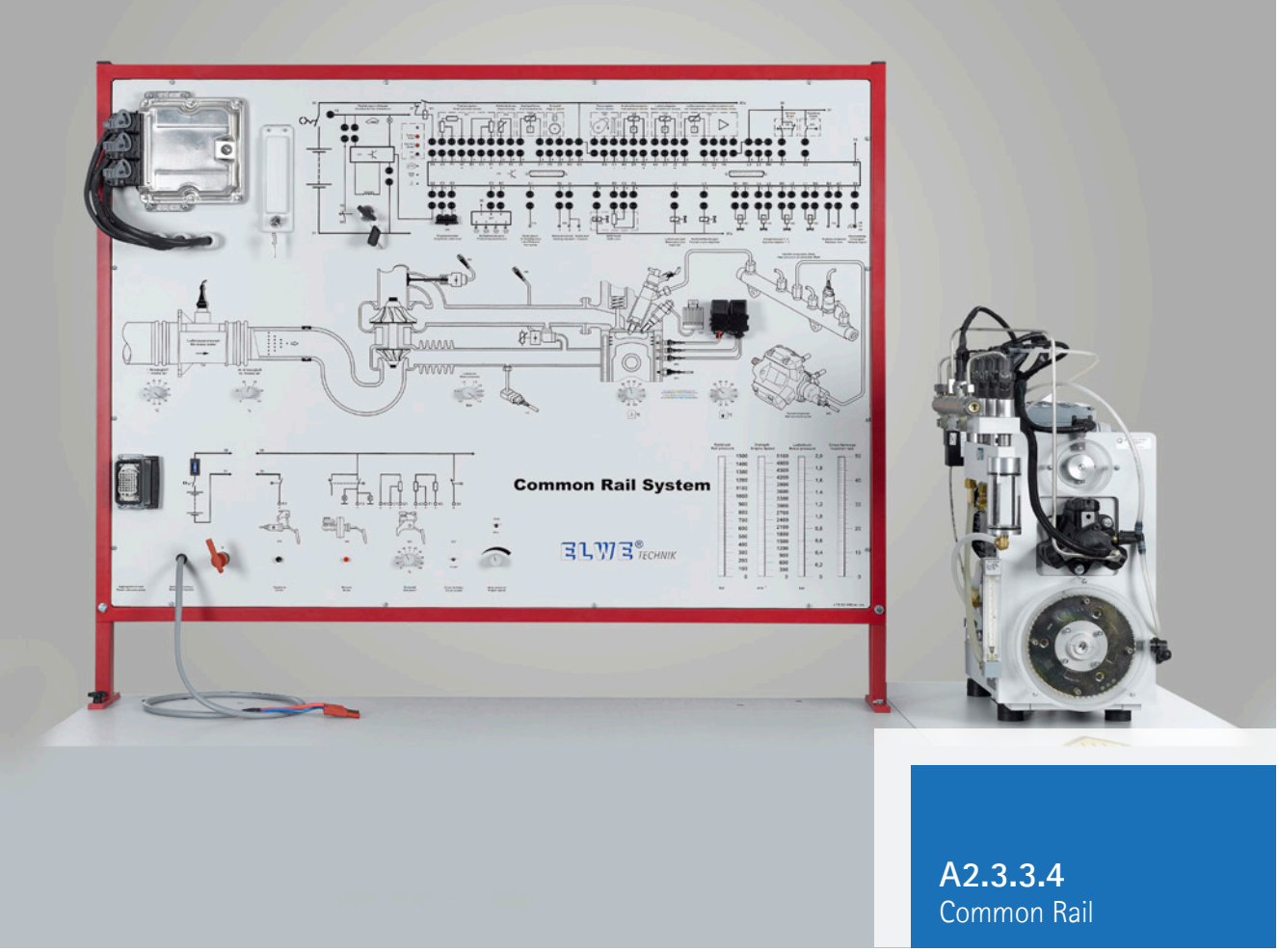
TARGET GROUP:

Vocational training in the car trade and automobile industry

No preliminary knowledge is required to carry out the experiments.

TOPICS:

- Basic circuits (series and parallel connection)
- Ohm's Law
- Setup and mode of the operation of a relay
- Temperature-dependent resistance
- Electrical power
- Capacitor
- Inductance
- Semiconductor (diode, Z-diode, transistor, LED)
- Logical basic circuits



A2.3.3.4
Common Rail

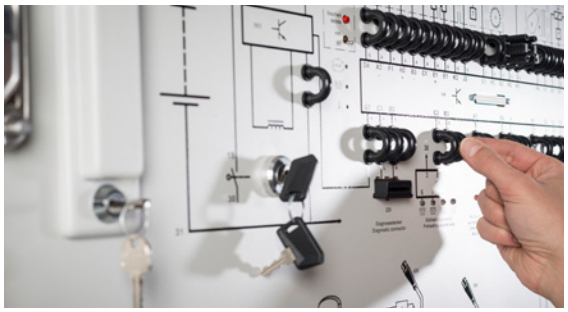
Common Rail technology is the world's most widespread diesel injection system used in current automotive production. Previously, on older types of diesel engines, a distributor pump with complex mechanical parts and injection nozzles determined the injection timing. On the newer Common Rail systems a high pressure pump with a significantly simplified mechanical construction delivers a higher pressure, of up to 2300 Bar, to all the engine's electrically operated injection valves whose timing is electronically controlled.

LEARNING OBJECTIVES:

- Name the operating principle and components of a Common Rail motor management System
- Explain the function of the operating resources and operating elements
- Explain the setup and method of operation of a Common Rail System.

TOPICS:

- Components of a Common Rail System
- Analysis of circuit diagrams
- Commissioning and measurement of electrical variables
- Camshaft and crankshaft signal
- Cold start
- Rail pressure control
- Common Rail injector
- Exhaust gas recovery
- Charging pressure
- Air mass measuring device
- Fault diagnosis
- Self-diagnosis with workshop tester



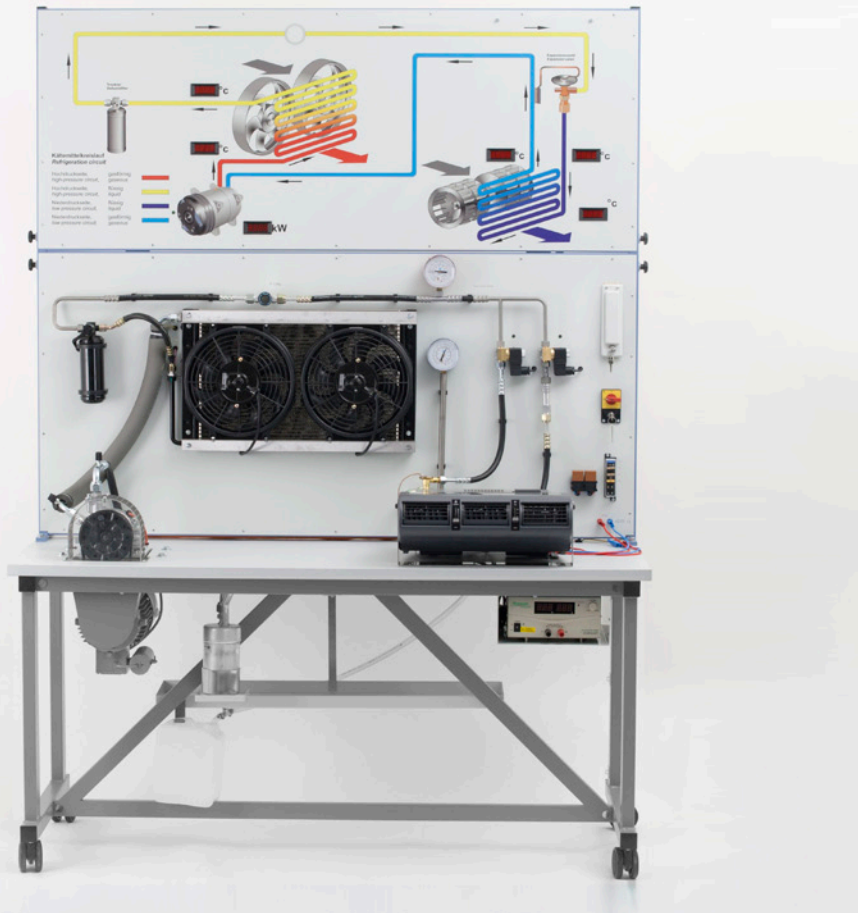
LEARNING METHOD:

Demonstration and student experiment

TARGET GROUP:

Trainees in the automotive sector

No preliminary knowledge is required to carry out the experiment.



A2.4.1.6
Refrigeration Circuit

To outline and deepen knowledge about how to establish a pleasant climate within a motor vehicle ELWE Technik has divided this unit into two distinct areas of "The Refrigerant Circuit" and "Climate Control".

LEARNING OBJECTIVES:

- Analysis of the system of air-conditioning automation
- Formulation of basic control processes
- Introduction to self-diagnosis

This training system treats the essential content of the subject in detail. A refrigerant circuit was developed, which, as an experiment bench represents two different refrigeration methods that can be activated via a solenoid valve (refrigerant circuit with expansion valve or throttle valve).

This experiment bench can also be used in other areas of training related to refrigeration.

LEARNING METHOD:

Student experiment following practical examples

TARGET GROUP:

Vocational training in the automotive sector and industry

Principles concerning function and provisions of the air-conditioning system

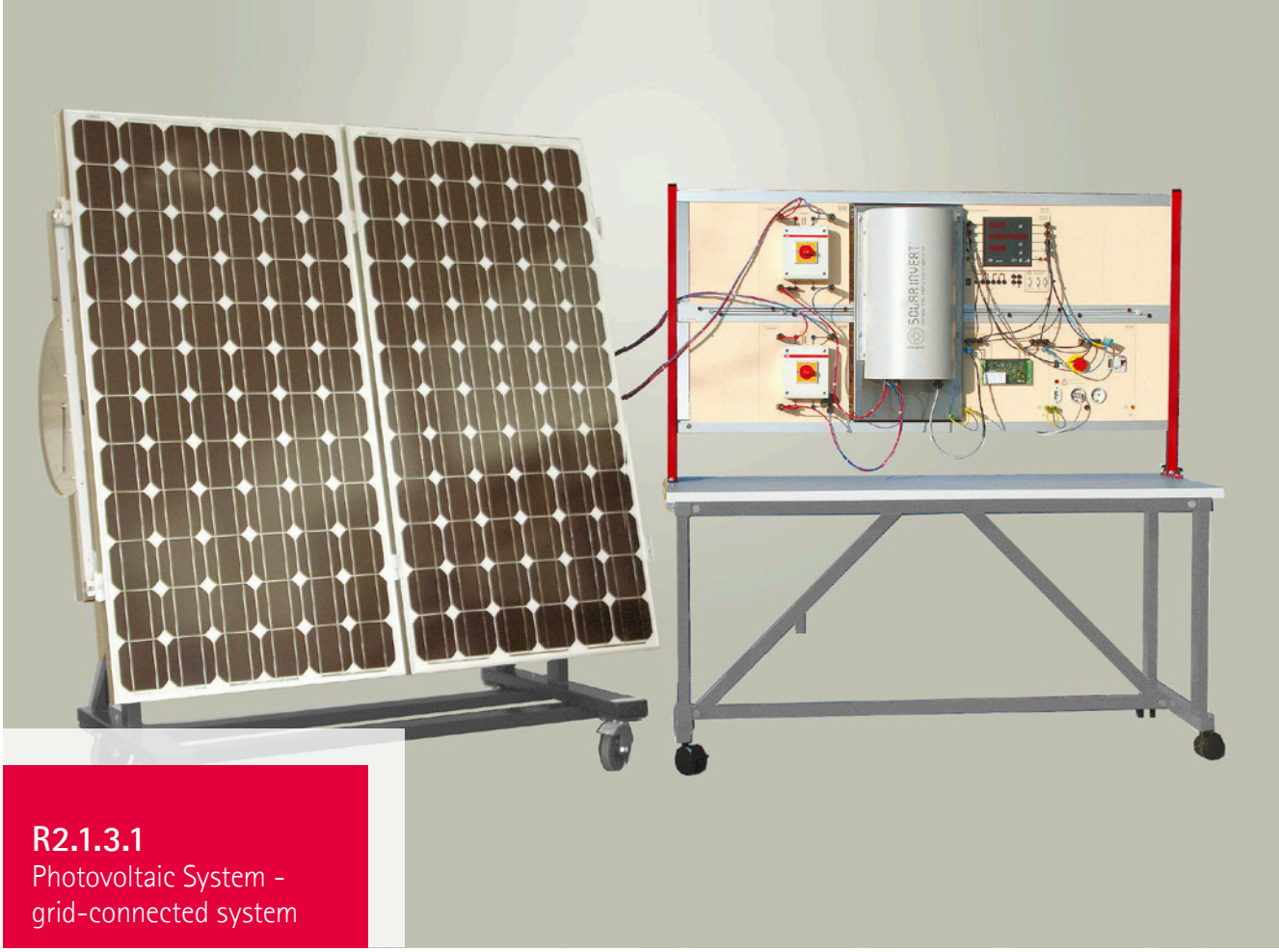
TOPICS:

- Learning situation: „Cold feet" during air-conditioning operation
- Learning situation: Air flow cannot be set
- Learning situation: Absent cooling output

AUTOMOTIVE TECHNOLOGY

FURTHER INTERESTING AUTOMOTIVE
PRODUCTS AND EQUIPMENT SETS
ARE AVAILABLE AT:

WWW.ELWE-TECHNOLOGY.COM
WWW.LD-DIDACTIC.COM



R2.1.3.1
Photovoltaic System - grid-connected system

The grid-connected ELWE Technik Photovoltaic System is a compact training system with standard industrial components.

LEARNING OBJECTIVES:

- Effect of intensity and incidence angle of the sunlight on the output power.
- The setup and function of the system components are described.

Compact solar system assembled from industrial components on two carriages.

The system comprises:

- Solar panel
- DC load disconnecting switch
- Disconnection device
- Grid feed
- Grid monitoring

LEARNING METHOD:

Student experiment or demonstration experiment. Experiments are to be carried out based on the relevant literature. Measurements of current, voltage and solar intensity can be ascertained.

TARGET GROUP:

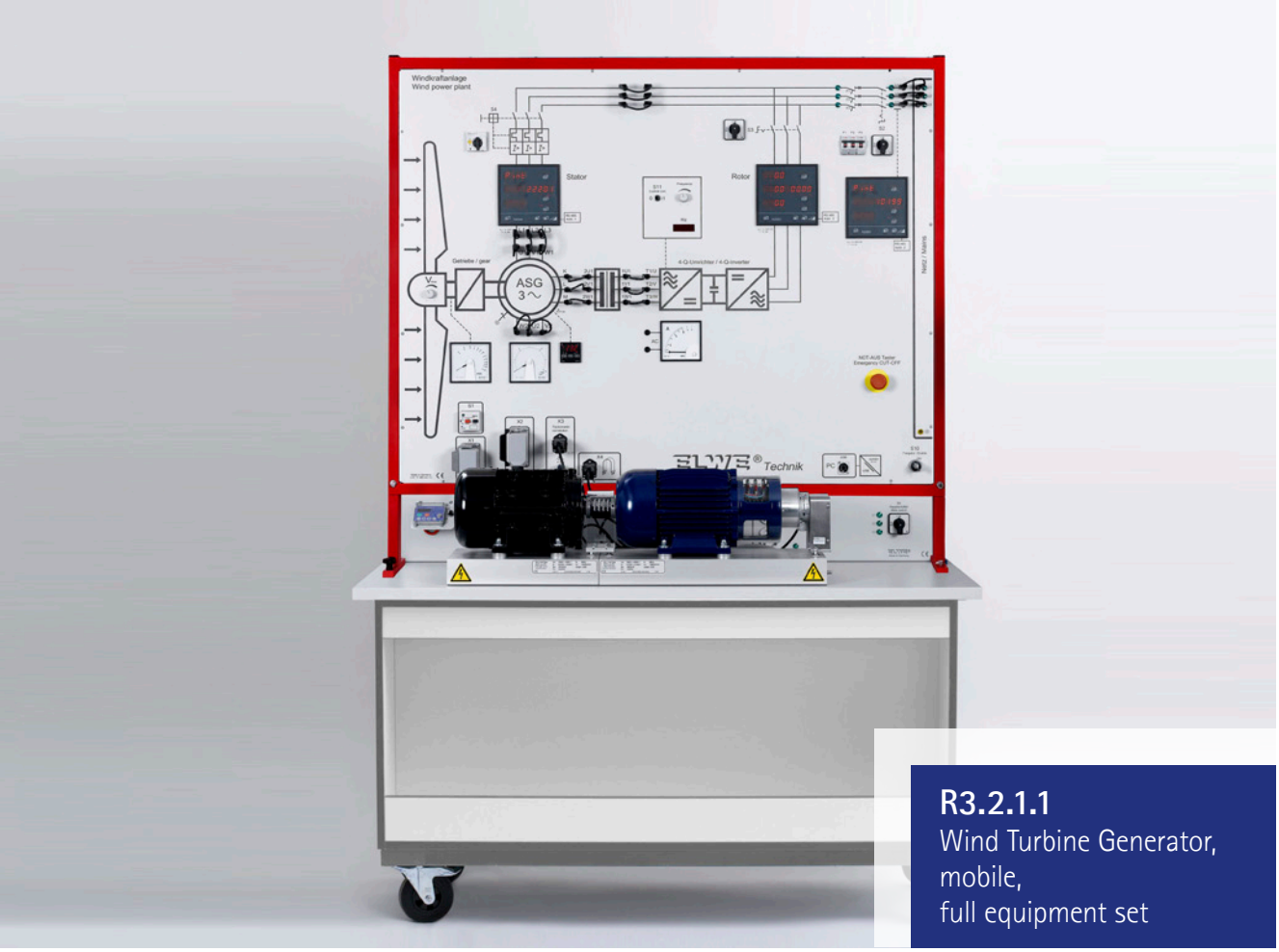
Training in the installation trade, as well as Master's programmes and technician training.

Very practical system at an intermediate technical level.

Knowledge of the principles of solar power systems is a prerequisite.

TOPICS:

- Setup and installation of photovoltaic systems
- Commissioning of photovoltaic systems
- Testing of photovoltaic systems
- Efficiency of a photovoltaic system
- Function of the inverter
- Fault response of a photovoltaic systems upon grid failure



R3.2.1.1
Wind Turbine Generator, mobile, full equipment set

The ELWE Technik Wind turbine generator is an experiment bench for the examination of asynchronous generators in wind energy systems.

LEARNING OBJECTIVES:

- Function of the single fed asynchronous generator
- Function of the dual fed asynchronous generator

Experiment bench with asynchronous generator, wind simulator and 4-quadrant frequency inverter.
The trainee first acquires basic knowledge of electrical energy production through exploitation of the kinetic energy present in the wind. The trainee learns various common methods of connecting the asynchronous generator to the grid to channel energy.
In particular, the importance of compliance with the correct direction of rotation of the generator is a major point of focus and the transition from the motor to the generator with increasing speed is explained to the student.

TOPICS:

- Direct connection of the stator of an asynchronous short circuited rotor generator to the grid.
- Operation of the asynchronous short circuited rotor generator via a 4-quadrant inverter with grid-connect capability and full inversion for the stator at a constant frequency of 50 Hz
- Operation of the asynchronous short circuited rotor generator via the 4-quadrant inverter with full inversion for the stator at different frequencies with a rpm-variable method of operation at speeds for the 4-pole generator between approx. 1250 and 2150 revolutions per minute.
- Use of the generator as dual fed asynchronous generator with connection of the rotor via the 4-quadrant inverter to the grid.

At the same time, he or she is supported by the measuring instruments that display all required variables.

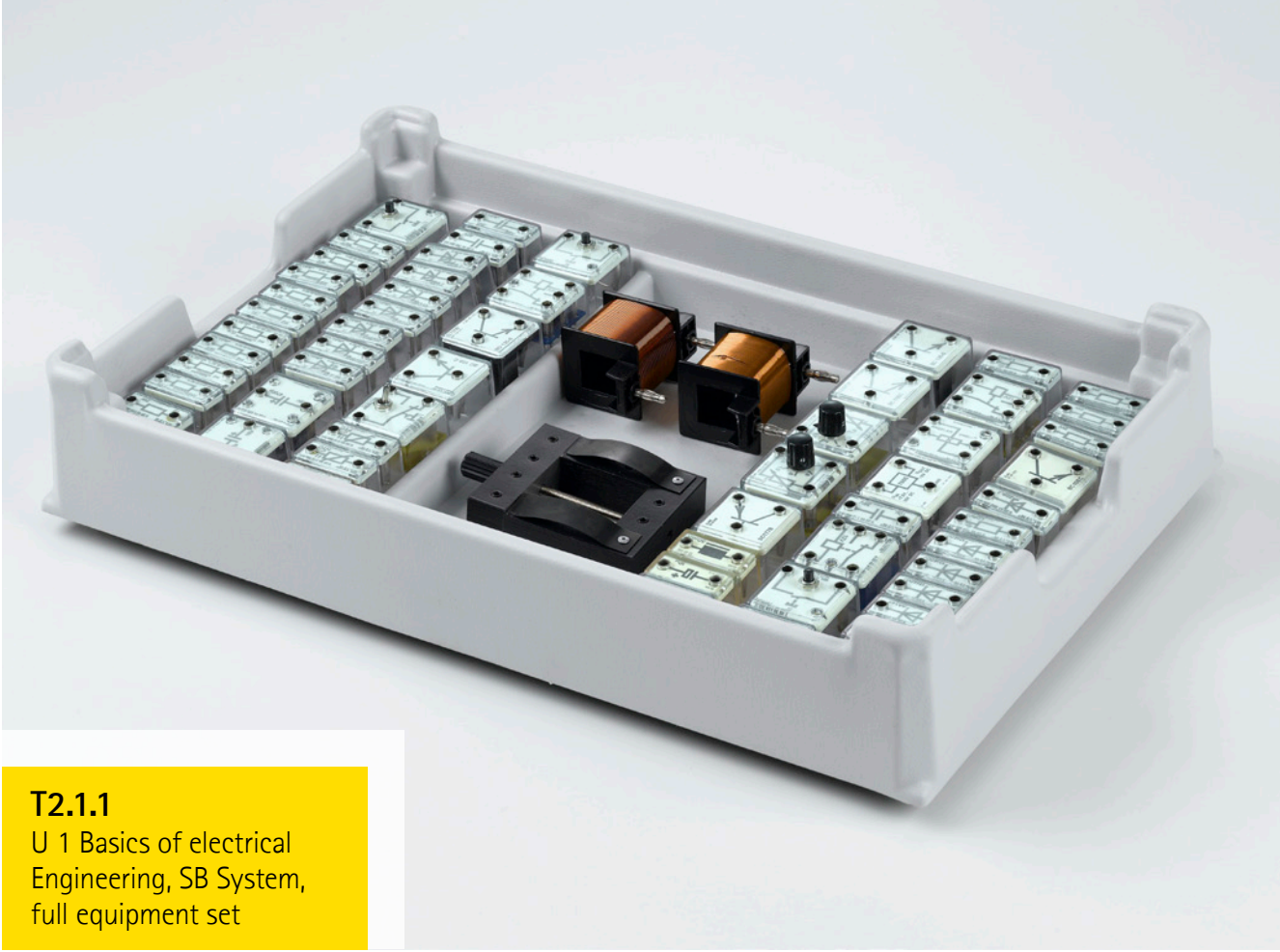
LEARNING METHOD:

This equipment is designed for student or demonstration experiments.

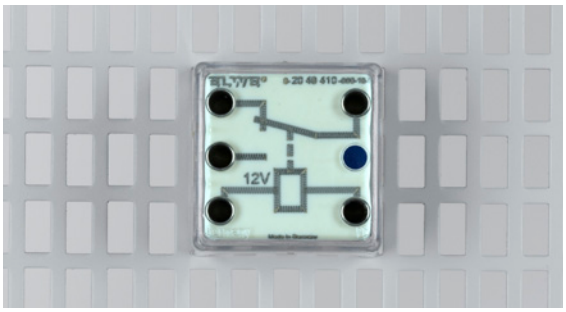
TARGET GROUP:

This system is suitable for the area of energy technology in technical colleges and universities for Bachelor and Master programmes.

A basic understanding of the asynchronous machine is a prerequisite.



T2.1.1
U 1 Basics of electrical Engineering, SB System, full equipment set



Primarily taught in this system are the basic principles of electrical engineering, electronics and digital technology.

LEARNING OBJECTIVES:

- Fundamental basics of Electrical Engineering
- Basic elements of Electrical Engineering
- Basic circuits of Electrical Engineering
- Measurement of electrical circuits

LEARNING METHOD:

At ELWE Technik, the basic principles of electrical engineering are taught using plug-in modules connected into a PCB stripboard with 5 x 5 mm or 5 x 10 mm hole pitch. In this way, the system is compatible up as far as the box system constructions.

The basic elements and modules of electrical engineering will be dealt with in a series of well-structured experiments.

Students will learn through hands-on experience using practical and realistic examples. The basis of the experiments is the use of measuring instruments to determine electrical values and the behaviour of these in the individual circuits.

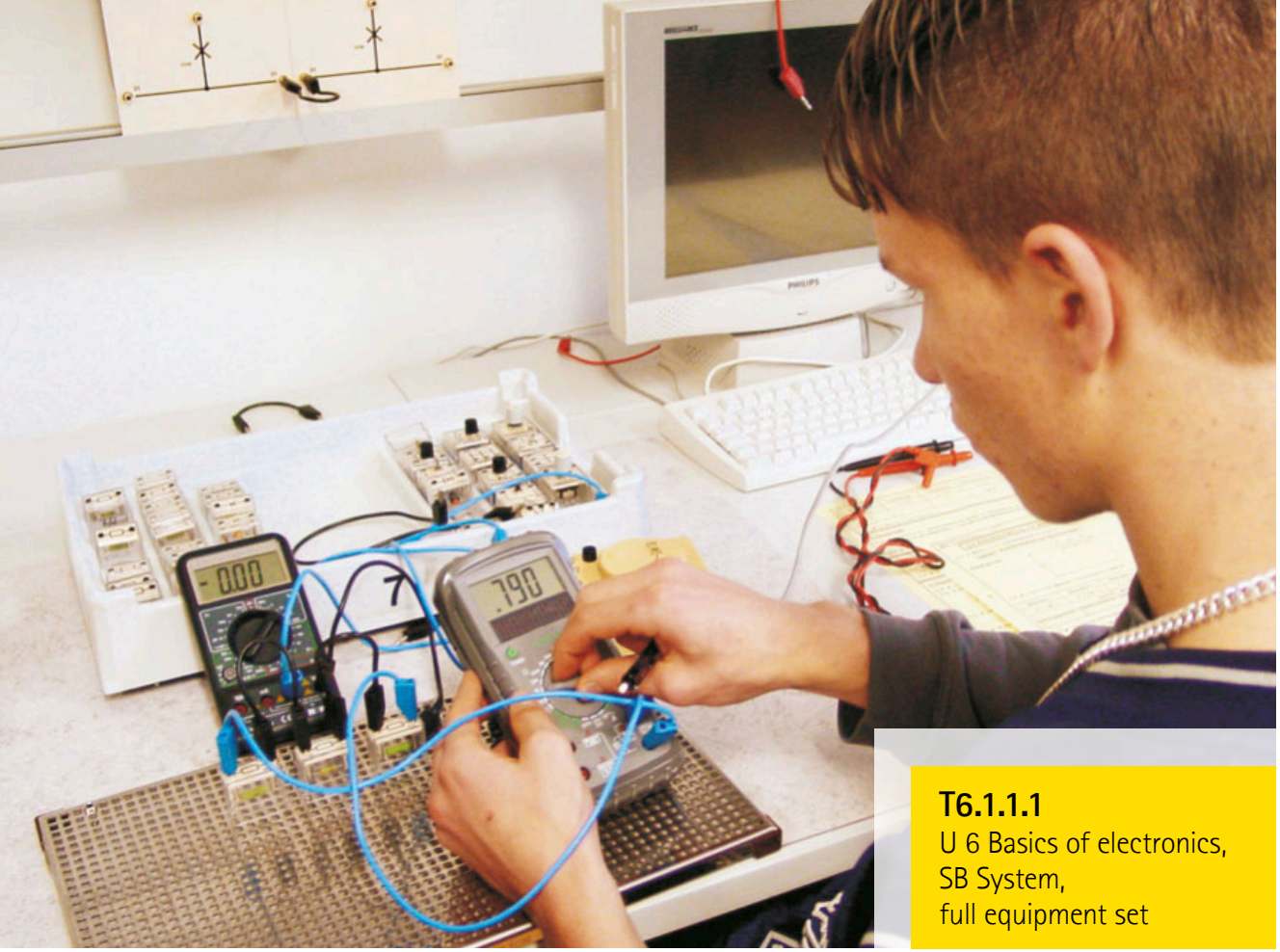
TARGET GROUP:

Trainees in commercial trade, for all disciplines where basic knowledge in electrical engineering is required.

Students in Bachelor's program as basic exercise to get familiar with measuring devices and evaluation procedures.

TOPICS:

- Measurements of voltages
- Measurement of current
- Resistors connected in series
- Resistors connected in parallel
- Switches
- Batteries
- Kirchhoff's first and second law
- Ohm's law



T6.1.1.1
U 6 Basics of electronics,
SB System,
full equipment set

This system primarily imparts the fundamentals of electronics, based on the fundamentals of electrical engineering.

LEARNING OBJECTIVES:

- Fundamental basics of electronics
- Special features of electronic components and their basic circuits

LEARNING METHOD:

At ELWE Technik, the basic principles of electronics are taught using plug-in modules connected into a PCB stripboard with 5 x 5 mm or 5 x 10 mm hole pitch. In this way, the system is compatible up as far as the box system constructions.

The basic elements and modules of electronics will be dealt with in a series of well-structured experiments.

Students will learn through hands-on experience using practical and realistic examples. The basis of the experiments is the use of measuring instruments to determine electrical values and the behaviour of these in the individual circuits.

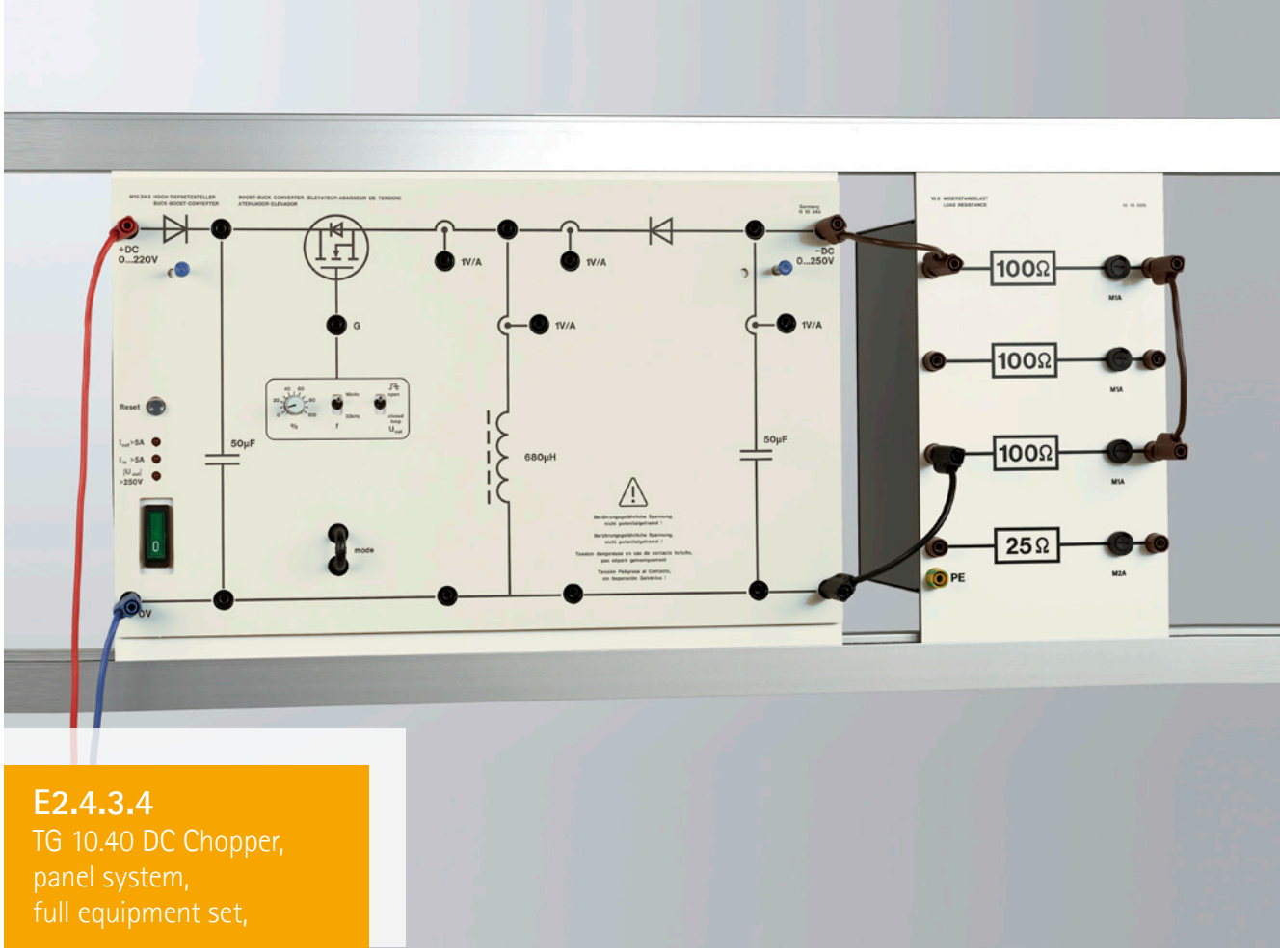
TOPICS:

- Diodes and the semiconductor junction
- Z diodes
- NPN transistors
- PNP transistors
- Rectifier circuits
- Simple voltage stabilisation
- The transistor as an amplifier
- The transistor as a switch

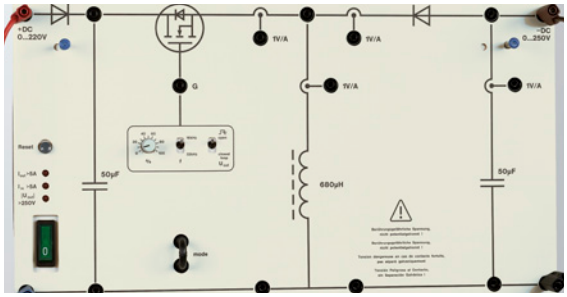
TARGET GROUP:

Trainees in commercial trade, for all disciplines where basic knowledge in electrical engineering is required.

Students in Bachelor's programme as basic exercise to get familiar with measuring devices and evaluation procedures.



E2.4.3.4
TG 10.40 DC Chopper,
panel system,
full equipment set,



Equipment set for examining chopper converters.

LEARNING OBJECTIVES:

- Chopper converter with MOS-FET
- Chopper converter with Darlington Transistor
- Chopper converter with IGBT
- Chopper converter with Thyristor

The set has been developed by ELWE Technik with a focus on system analysis and circuit setup. The basic system comprises a control unit, which is optionally connected to two different power units.

The control unit enables three connection variants for activating the power semiconductors:

- Manual control of scanning level and scanning frequency.
- Current control with analogue guide variable input.
- Current control with 8-bit digital/analogue converter input.
- Rotational frequency control with subordinate current control.

PERFORMANCE FEATURES:

- The use of masks ensures a compact, clear and highly visible experiment setup as well as a high level of operating safety.
- The control unit with controller functions and the power unit of the chopper converter are set up with spatial separation corresponding to the normal representation in the circuit diagrams of industrial devices.
- The signal transmission between the control and power unit occurs optionally via the conventional two-wire line or a modern optical waveguide.
- The control unit enables three connection variants for manual activation, via analogue input 0..10V DC, via 8-bit PLC or PC input or using the integral rotational frequency controller with subordinate current control for a DC drive.

LEARNING METHOD:

Student or demonstration experiment. The experiments are carried out as specified in the literature, the results are recorded by measuring with an oscilloscope and multimeters.

TARGET GROUP:

The target group is trainees in trade and industry and students of energy technology and electronics. The course offers experiments at an intermediate level for vocational colleges and for Bachelor programmes.

Basic knowledge of electronics is a prerequisite.

TOPICS:

- Chopper converter MOS-FET under different loads
- Chopper converter Darlington transistor under different loads
- Chopper converter IGBT under different loads

E2.5.3.10
Efficiency machine as electronically controlled drive

Experiment with a permanently excited synchronous machine and a frequency converter without electronic commutation.

LEARNING OBJECTIVES:
- Use of efficiency machines
- Setting up a drive with a permanently excited synchronous machine and frequency converter.

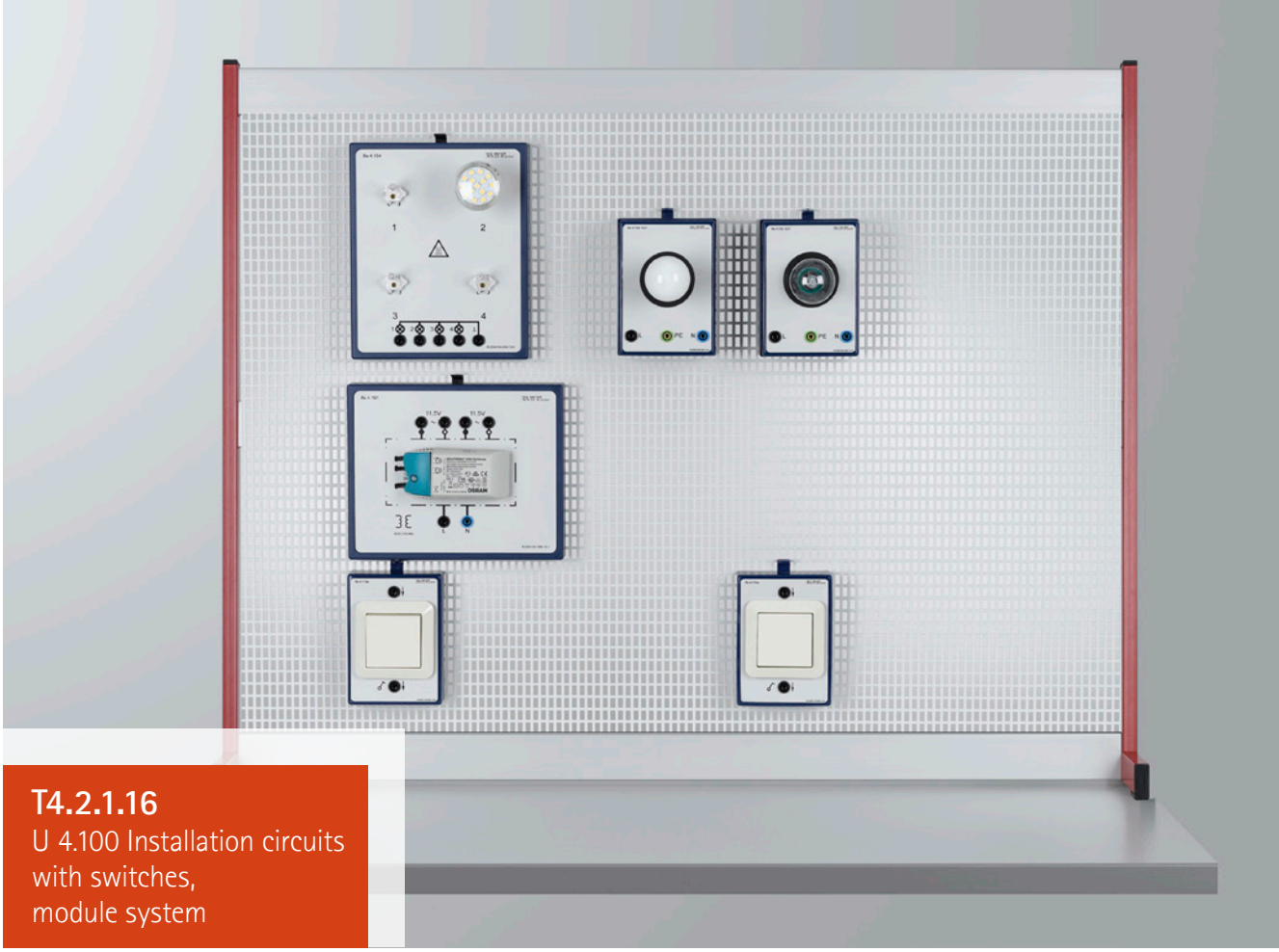
Panel system, comprising a permanently excited synchronous machine, asynchronous machine and industrial frequency converter as well as the machine test system.

LEARNING METHOD:
Student experiment or demonstration experiment. Determining the efficiency of an electrical machine.

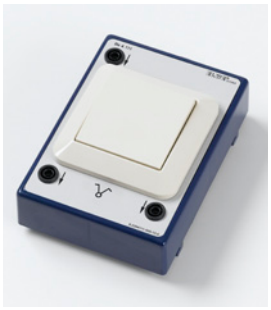
TARGET GROUP:
The target group is trainees in trade and industry and students of energy technology. The course offers experiments at an intermediate level for vocational colleges and for Bachelor programmes.

The principles of electrical machines are a prerequisite.

TOPICS:
- Efficiency of machines
- Identification of efficiency classes
- Application model for highly-efficient machines



T4.2.1.16
U 4.100 Installation circuits with switches, module system



Student experiments involving installation technology with modules on mounting wall.

LEARNING OBJECTIVES:

- Basic elements of installation technology
- Basic circuits of installation technology
- Basic circuits of lighting technology

The experimentation module system comprises convenient, robust experimentation modules that can be individually arranged on a mounting wall freely and clearly corresponding to the circuit diagram. The modules are also coloured for a better overview.

A transparent rear wall enables the conventional equipment used to be viewed. The module engages in the mounting wall with the help of an elastic catch, thus preventing it from falling out when inserting the connecting elements.

The electrical components are connected directly to the corresponding safety sockets using 4-mm safety connecting lines for low voltage and 2-mm safety connecting lines for extra-low voltage.

LEARNING METHOD:

Student experiments following task description in the manual.

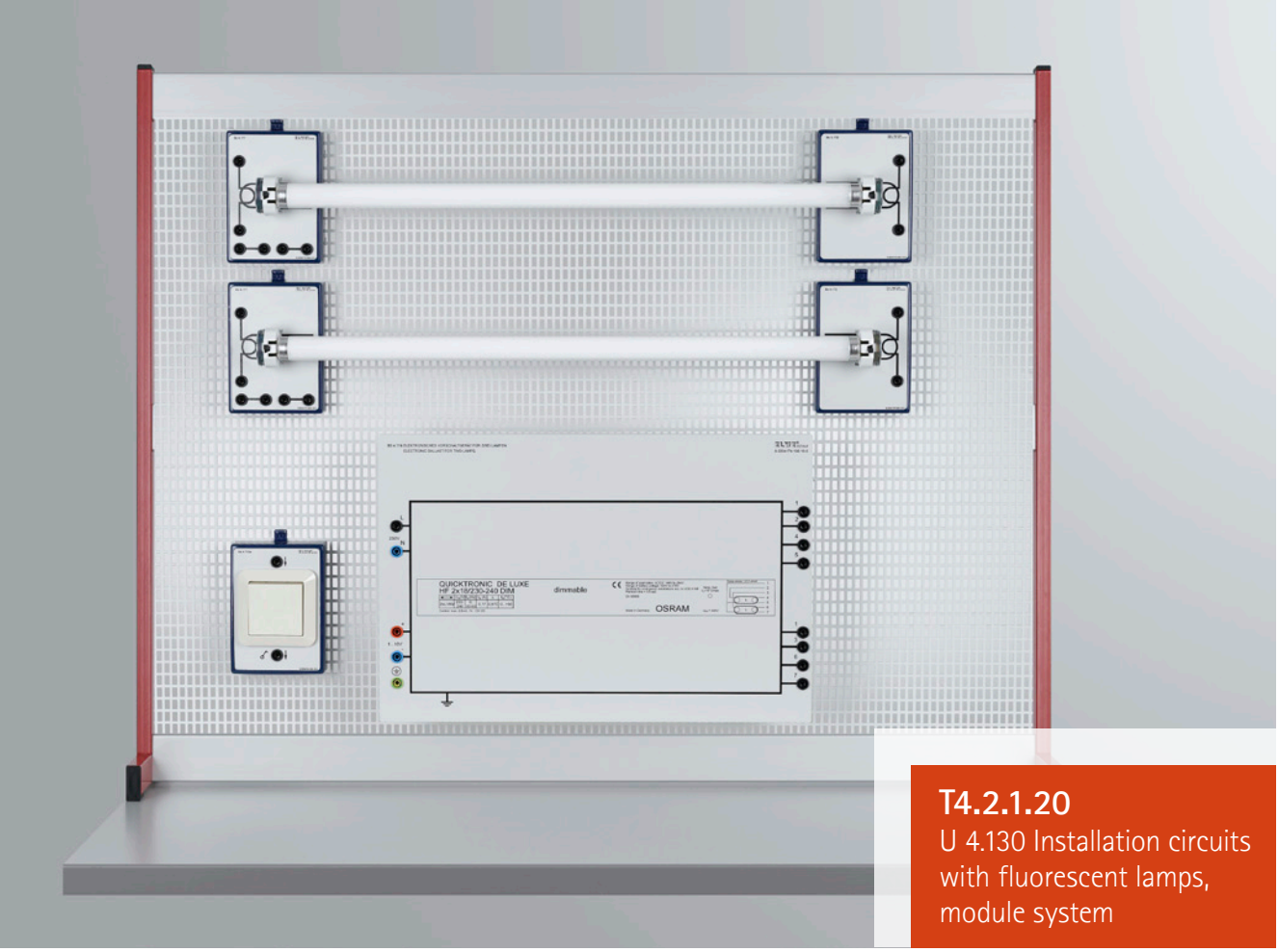
- Arrangement of the elements
- Routing the wiring
- Checking the function

TARGET GROUP:

Vocational training: Electrical engineering in trade and industry

Low learning level, preliminary knowledge: Principles of installation technology and instruction about the dangers of electrical engineering.

The system could be supplemented by protection measures.



T4.2.1.20
U 4.130 Installation circuits with fluorescent lamps, module system

EQUIPMENT SETS:

T4.2.1.16 U 4.100 Installation circuits with switches
- Connecting an activation point (off, series and group circuits)
- Connecting two activation points (two-way connections)
- Connecting more than two activation points (cross connection)

T4.2.1.17 U 4.110 Installation circuits with buttons, supplementary equipment set
- Connecting an activation point (off, series and group circuits)
- Connecting two activation points (two-way connections)
- Connecting more than two activation points (cross connection)

T4.2.1.18 U 4.115 Bell system and door opener, supplementary equipment set
- Acoustic bell system without door opener
- Acoustic bell system with door opener

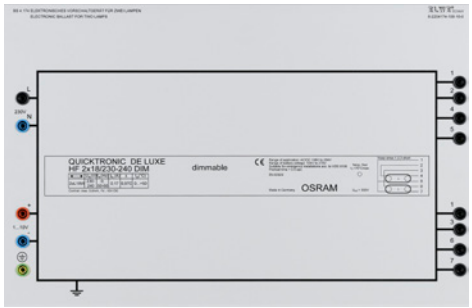
T4.2.1.19 U 4.120 Switching and dimming filament and halogen lamps
- Dimmer circuits

T4.2.1.20 U 4.130 Installation circuit with fluorescent lamps
- Single circuit with glow starter
- Single circuit with fuse quick starter
- Single circuit with electronic starter
- Dual circuit
- Tandem circuit
- Dimming

T4.2.1.21 U 4.140 Light technology
- Metal halide lamps

T4.2.1.26 U 4.500 Photovoltaic module system, full equipment set
- Determination of electrical characteristic data for a solar module
- Components of a photovoltaic island system
- Electrical safety of a photovoltaic system
- Inverter
- Solar backup power supply

T4.2.1.31 Wall for concealed installation with accessories and tools
- Practical exercises with flush installation material



T11.2.5.1
TG 17.410 Double busbar system

The Double Busbar compact system focuses its use in the area of "switching in switchgear of the energy transmission".

LEARNING OBJECTIVES:

- Familiarisation with the switching sequences by authorised persons
- Simulation of faults
- Protection against incorrect connections

The model represents double busbar switchgear with 8 switching fields. It is designed so that the requirements from both the network and from power station operation are considered practically.

Two busbar interfaces are mapped. The interlock conditions in a switching system can therefore be learnt in order to be able to conduct all switching actions appropriate to the situation and safely in the network and power station operation. The model of the double busbar switchgear is therefore designed so that all practical operating resources, feeds, outlets, coupling, earthing and measurement are considered.

As standard control acknowledgement switches and synchronisation devices are used, and because the representation of the system also corresponds to practice, the trainee will find the switchgear familiar. The student can practice on a system here, which he will encounter later in his or her vocational life.

All switching actions are monitored by a switching fault protection system. The can be operated locked and unlocked.

Impermissible switching is prevented in the locked state. If unlocked, the impermissible switching is not prevented but signalled immediately. Before further switching action is possible, the faulty switching must be reset.

This makes exercises possible, which are not even possible with a shut-down system in practice.

LEARNING METHOD:

Student experiment or demonstration experiment. Experiments are to be carried out according to the associated literature.

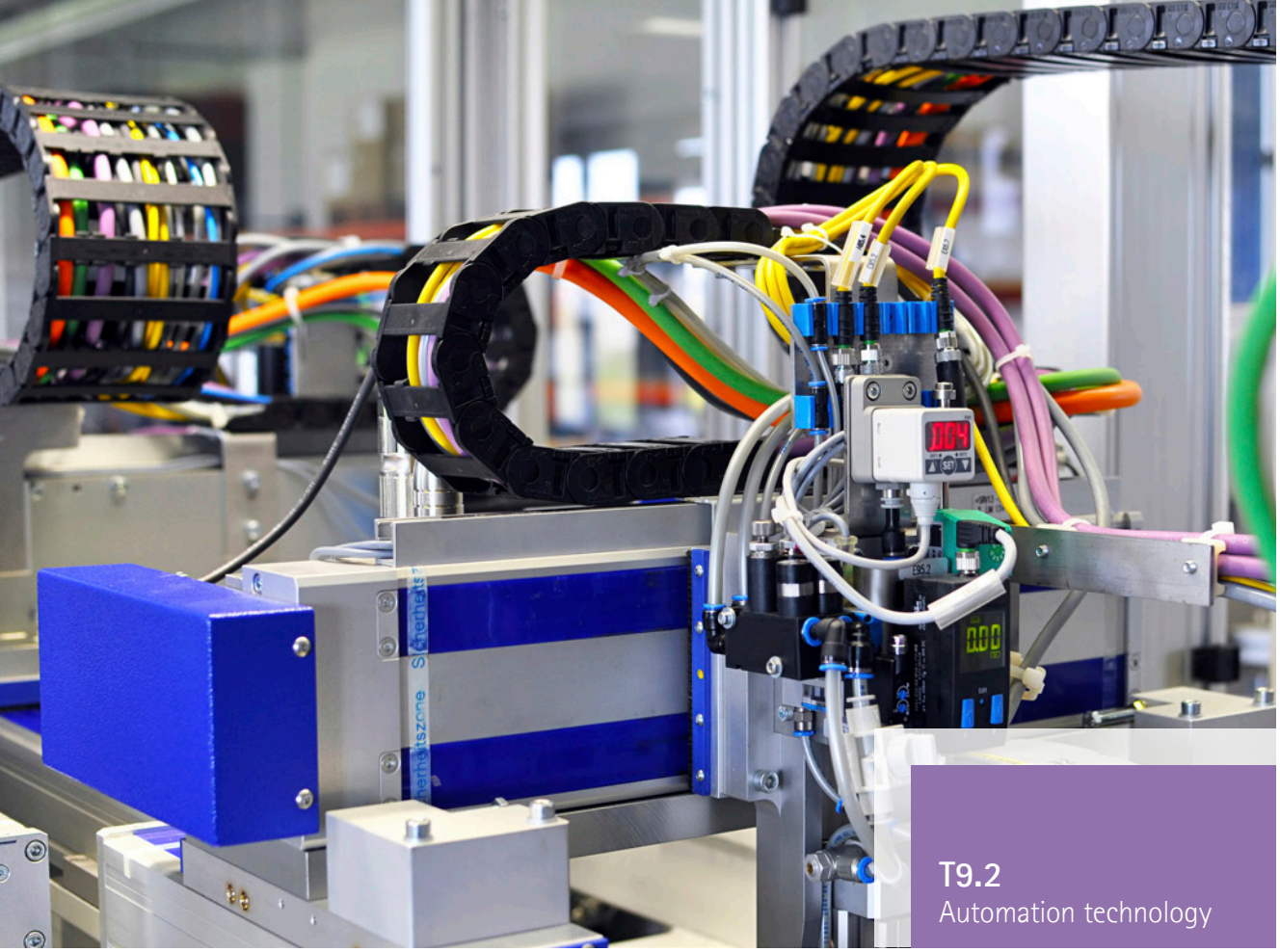
TARGET GROUP:

Control room engineer, foreman and technician training, as well as for students as part of a Bachelor programme.

Basic knowledge of technical energy systems is required.

TOPICS:

- Earthing the system
- Switching off longitudinal couplings, busbar change
- Establishing single busbar operation
- Use of the coupling performance as a reserve power switch
- Unearthing and commissioning an output
- Establishing dual busbar operation from the diagonal coupling
- External feeding



T9.2
Automation technology

Automation technology combines the technical fields

- **Mechanical engineering**
- **Electrical engineering**
- **Electronics**
- **Open-loop control technology**
- **Closed-loop control technology**
- **Information technology**
- **Communication technology**

with the aim of operating devices and systems autonomously.

LEARNING OBJECTIVES:

- Operation of devices and systems autonomously

The automation system at ELWE Technik contains both the demonstration experiment and the student experiment.

The following different concepts are available for this:

- Planel system
- Modul system
- Small system
- Transparent hydraulics

TOPICS:

- Contactor control
- Compact control
- PLC
- Functional model
- Transparent hydraulics

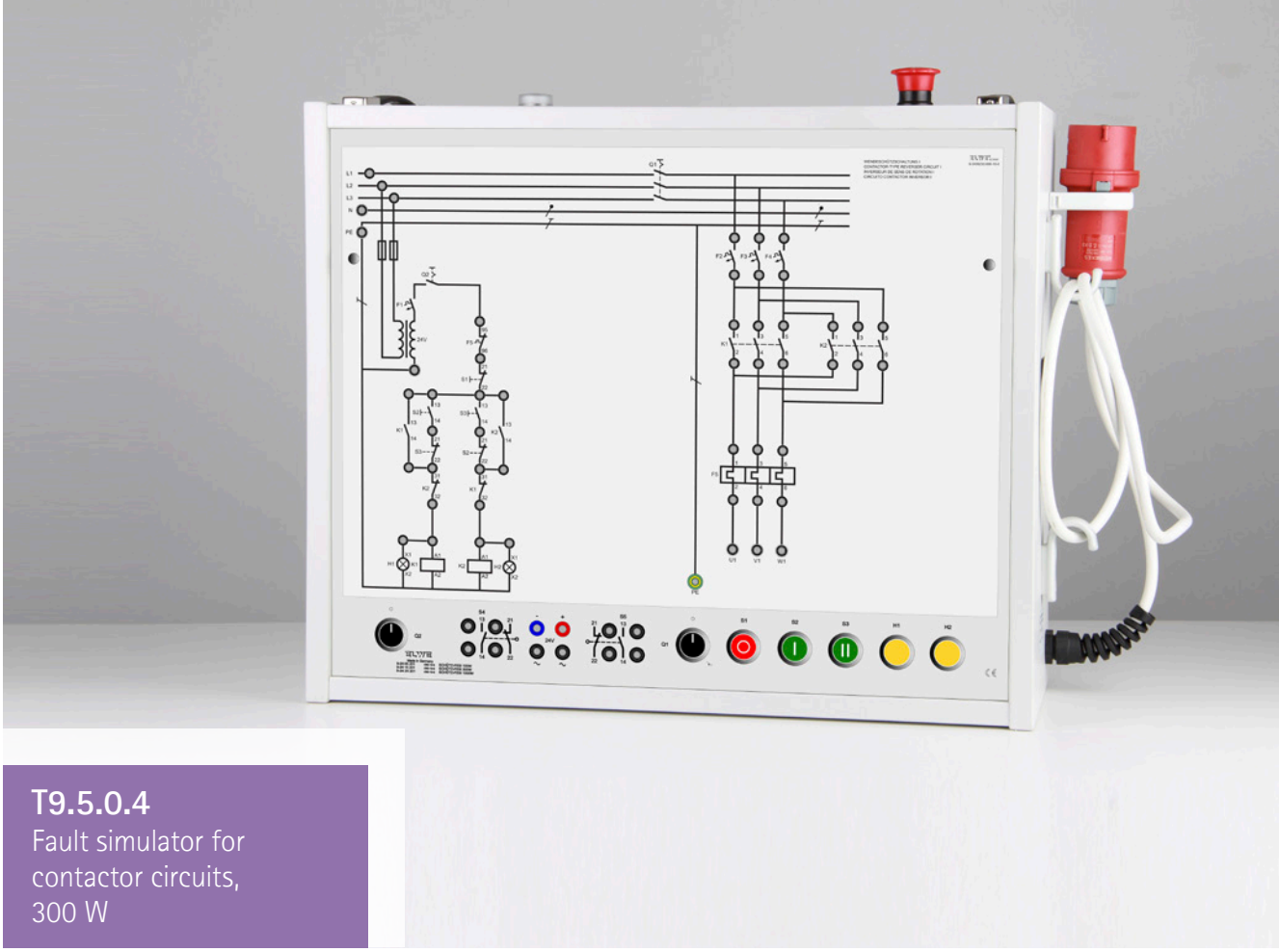
LEARNING METHOD:

These systems can be used for demonstration or for student experiments. Depending on the experiment, the focus is on wiring or programming.

TARGET GROUP:

The trainee/student is helped to gain knowledge in open-loop control, closed-loop control, information and communication technology.

The target group for these systems is training in trade, industry and study courses.



T9.5.0.4
Fault simulator for contactor circuits, 300 W

Fault localisation in contactor circuits. Compact device with integrated fault simulation.

LEARNING OBJECTIVES:

- Fault localisation in contactor circuits
- Function of contactor circuits

The core of the device is the front containing a large number of lead-throughs behind which the measuring and connecting points for the contactor circuits are located. By applying various masks, only the measuring and connection points remain available that are relevant to the circuit depicted on the mask. All points not required remain behind the mask.

The control panel is located in the lower part of the front face and contains switches, push-buttons, indicator lights and connection sockets for external limit switches.

On the left side of the practice device there is a switch panel behind a lockable door, which contains a programming field beside the main fuses and main key entry for the load circuit.

Two lamps for the control and load circuit and an EMERGENCY OFF pushbutton are mounted on the top of the practice device so as to be clearly visible to the trainer.

LEARNING METHOD:

Student experiments following task description in the manual. The measurements are made with a voltage tester and continuity tester.

The fault analysis is conducted in 4 steps:

- Description of the fault
- Presumed cause
- Fault determination by measurement
- Description of the test method

TARGET GROUP:

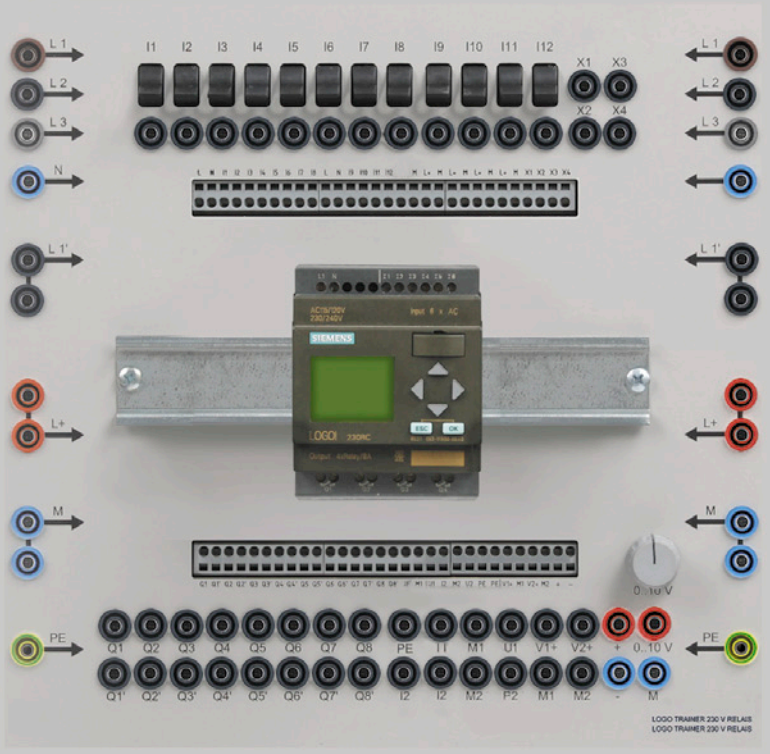
Vocational training: Electrical engineering in trade and industry

Medium learning level, preliminary knowledge concerning the contactor circuits to be analysed is required.

The required knowledge can be acquired by the equipment GT9.5.0.1 contactor circuits 230 V (module system) or GT9.5.0.2 contactor circuits 24 V (module system) or GT9.5.0.3 contactor circuits (panel system).

TOPICS:

- Switching on and off
- Reversing contactor circuit
- Reversing contactor circuit with limit buttons
- Automatic star-delta circuit
- Dahlander circuit
- Automatic Dahlander-reversing circuit
- Automatic Dahlander-reversing circuit with limit buttons



T9.5.1.11
LOGO!-Trainer 24 V DC
LOGO!-Networks

Programming a compact control on the Siemens LOGO! The student is to learn the essential functions of compact controls.

LEARNING OBJECTIVES:

- Compilation of programmes
- Learn logic and control functions
- Testing the programmes
- Establishing network connections

Panel or module system with all necessary digital and analogue inputs and outputs along with the required interfaces. The inputs and outputs can be accessed via 4-mm safety sockets. The Ethernet interface available depending on the set is designed in RJ 45.

LEARNING METHOD:

The learning method is a student or demonstration experiment.

The student is to learn the basic functions of control technology based on the task description.

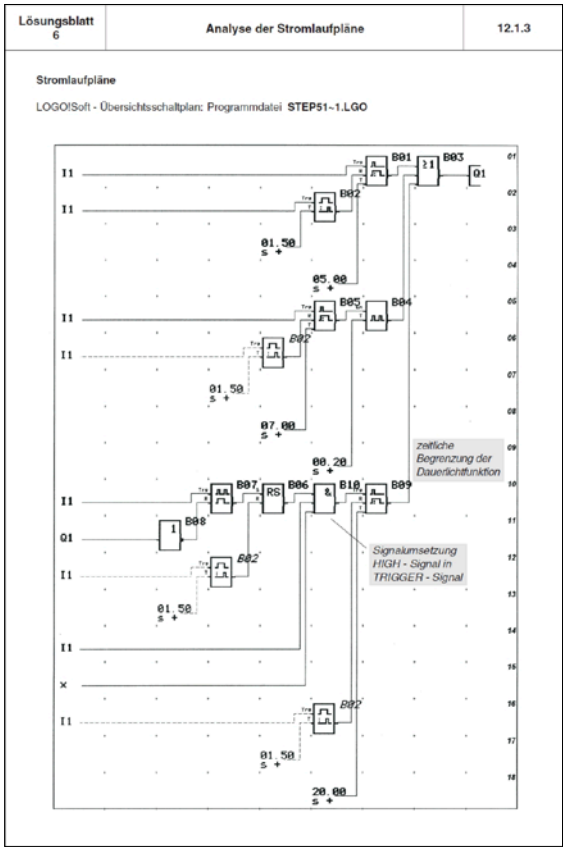
TARGET GROUP:

The target group is trainees in commercial business with a specialisation in energy and operating systems.

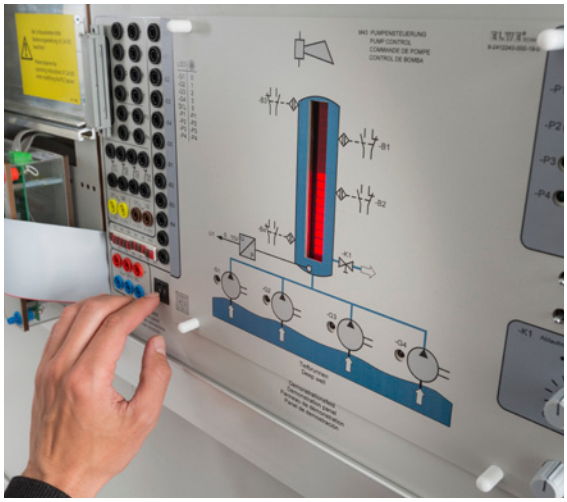
Basic knowledge of control technology is a prerequisite.

TOPICS:

- Clamping and assignment
- Blocks and block numbers
- Logical links
- Function block diagram
- Simulation of circuits



T9.5.1.19
ASIMA System simulator, full equipment set



The ASIMA system simulator Advanced is the optimum simulator for LOGO! S7-1200, S7-300 and S7-1500.

LEARNING OBJECTIVES:

- Programming of simple basic circuis
- Programming of compact systems
- Programming of complex systems and devices

This set contains the basic device ASIMA system simulator including tasks on CD.

The device is connected to the PLC via 4-mm safety sockets or via a 700 mm long, 50-pole ribbon cable.

- 12 digital inputs, 12 digital outputs
- 2 analogue inputs, 2 analogue outputs
- 4 relays with normally closed contact
- Control and display elements:
  - 6 buttons, 6 latching switches, 33 LEDs
  - 2 potentiometer with 0 ... 10 V DC
  - 1 bar display comprising 24 segments

In total, 33 systems/devices can be simulated. These are visualised via coloured masks on the basic device. The internal program for the relevant mask is selected via a coding switch.

LEARNING METHOD:

The device is designed for apprentice and student experiments.

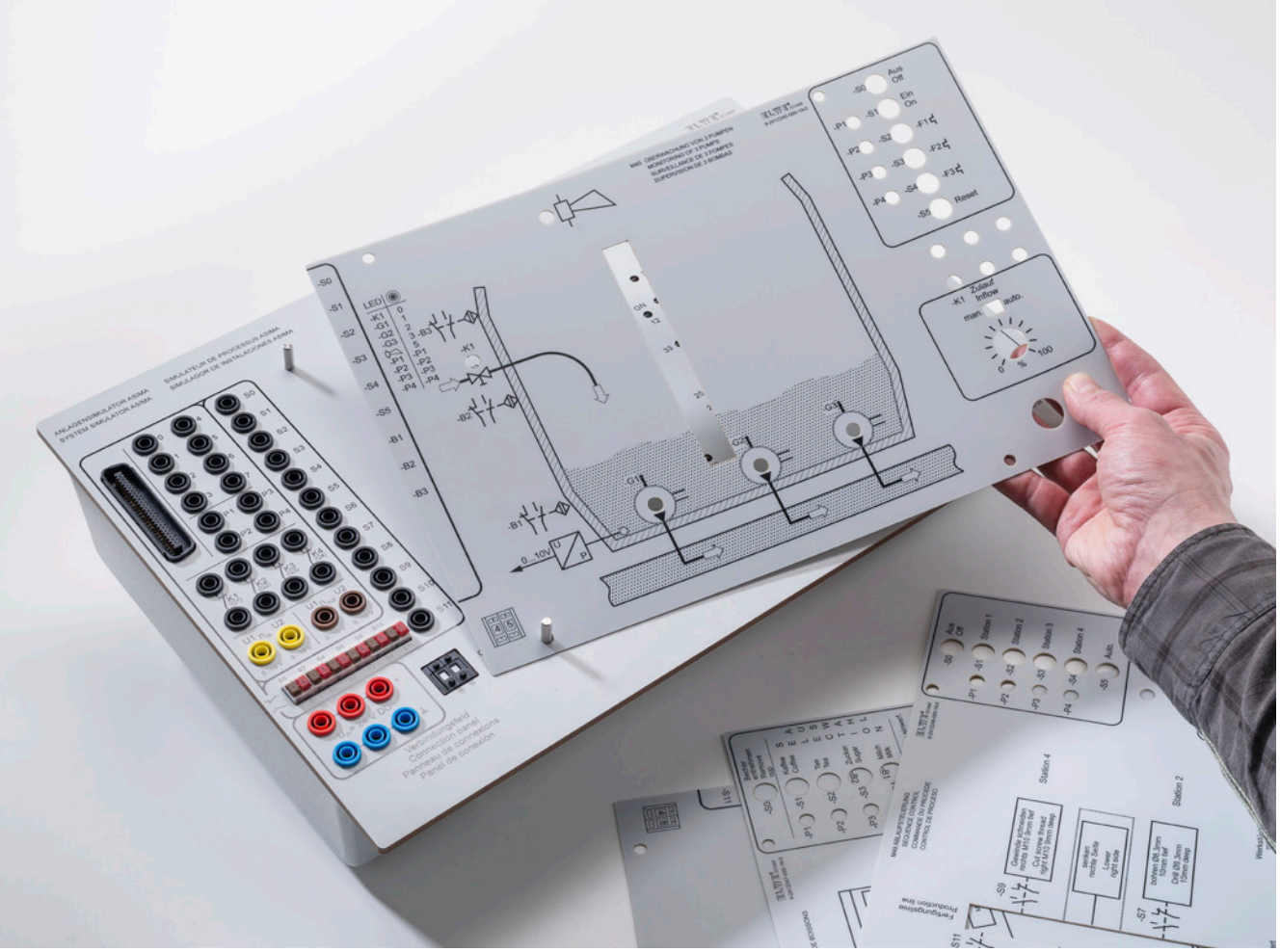
Practical tasks challenge the student to solve this control problem with his or her program. A solution approach is supplied as a file.

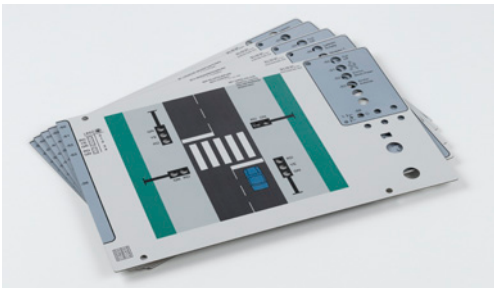
TARGET GROUP:

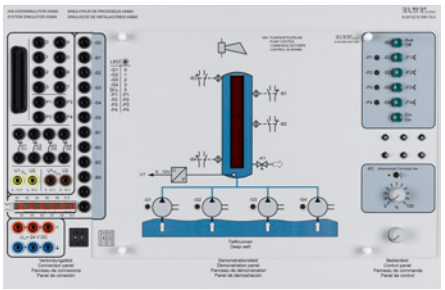
The target group are trainees in trade and industry and students of automation technology.

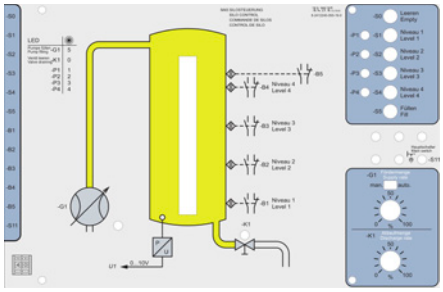
The course offers experiments at an intermediate level for vocational colleges and for Bachelor programmes.

Basic knowledge of programming principles is a minimum requirement.



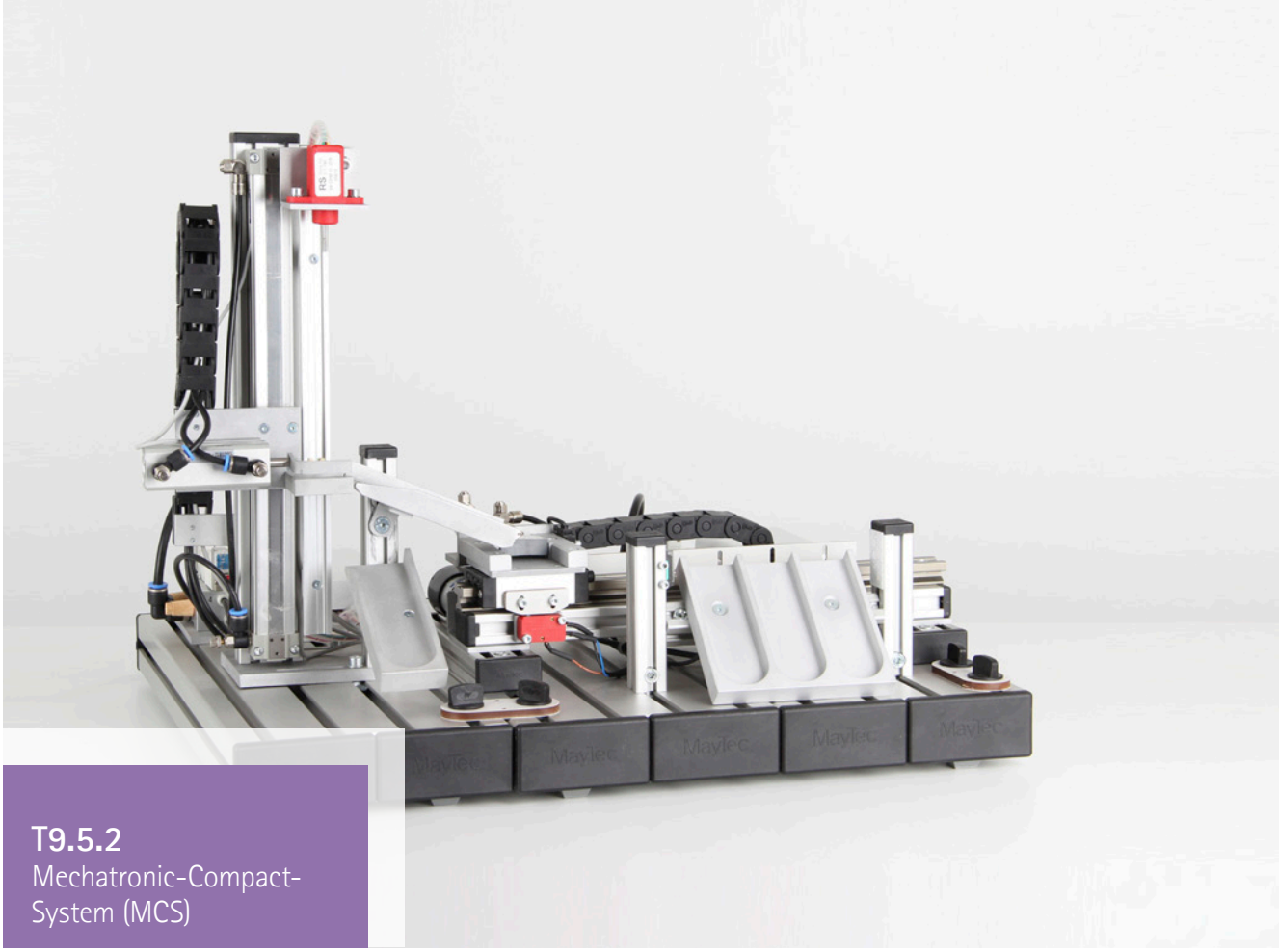




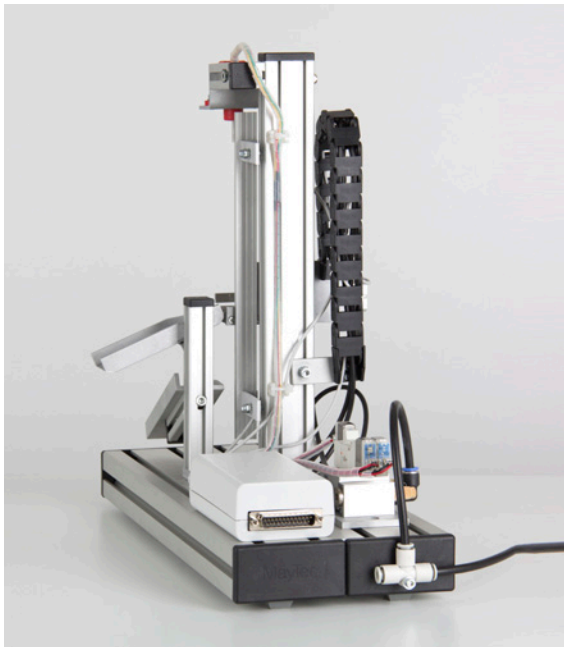


TOPICS/MASKS:

- Mask M1 Logic basic functions
- Mask M2 Digital functional modules
- Mask M3 Motor ON/OFF
- Mask M4 Reversing contactor
- Mask M5 Star-delta circuit
- Mask M6 Star-delta reversing circuit
- Mask M7 Reciprocating table control
- Mask M8 Dahlander circuit
- Mask M9 DS-motor with 2 coils
- Mask M10 DS-motor self-starter
- Mask M11 Conveyor belt system
- Mask M12 Reactive current compensation
- Mask M13 Heating control
- Mask M14 Running light
- Mask M15 Filling machine
- Mask M16 Tank system
- Mask M17 Coal mill
- Mask M18 Embossing machine
- Mask M19 Ventilator control
- Mask M20 Construction site light signalling system
- Mask M21 Light signalling system
- Mask M22 Collective transport conveyor
- Mask M23 Conveyor belt feeding system
- Mask M40 Silo control
- Mask M41 Reactor
- Mask M42 Load lift
- Mask M43 Pump control
- Mask M44 Wastewater pump system
- Mask M45 Monitoring of 3 pumps
- Mask M46 Pump system (pressure)
- Mask M47 Drinks machine
- Mask M48 Mixing system
- Mask M49 Process control



T9.5.2
Mechatronic-Compact-System (MCS)



The MCS Mechatronic-Compact-System for the occupational field of mechatronics comprises MCS modules that practically map typical process sequences as encountered in various branches of industry.

Knowledge and solutions for automation technology are provided with this system.

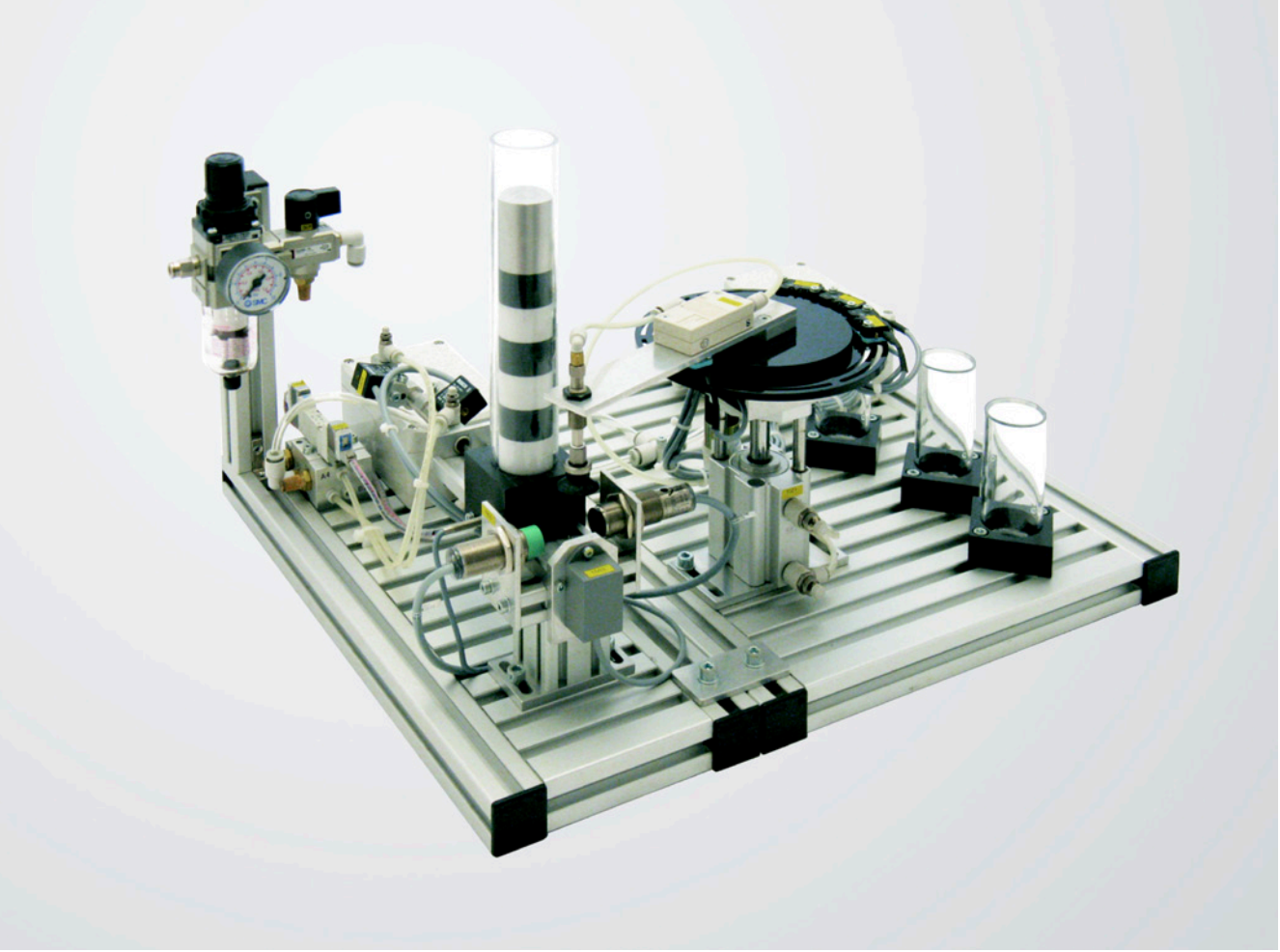
The MCS modules can be set up in conjunction with programmable controllers for systems of varying complexity.

Mechatronic-Compact-System, Benefits:

- Convenience: Compact transportable modules , can be set up on laboratory benches.
- Level of difficulty: Small and clear assemblies allow for easy and clear task setting. Depending on the number of modules, complex tasks are possible.
- Flexibility: Various technological setup variants are possible with multiple modules.
- Training benefits: Tasks can be assigned to several teams at the same time thanks to the various modules. The result of the team work can be tested on the assembled system.
- Quality: Industry-like design ensures high level of reliability and accuracy.

The models are offered in three basic equipment sets

- For beginners
- For experienced users
- For professionals



LEARNING OBJECTIVES:

- Knowledge and solutions for automation technology
- Knowledge of programmable logic controllers (PLC)

LEARNING METHOD:

Student experiments that are specified by a task description. The systems show the student the interaction between software and hardware.

TARGET GROUP:

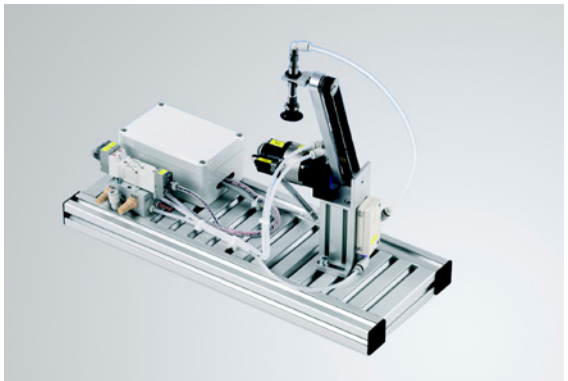
The target group is trainees in trade and industry and students of automation technology.

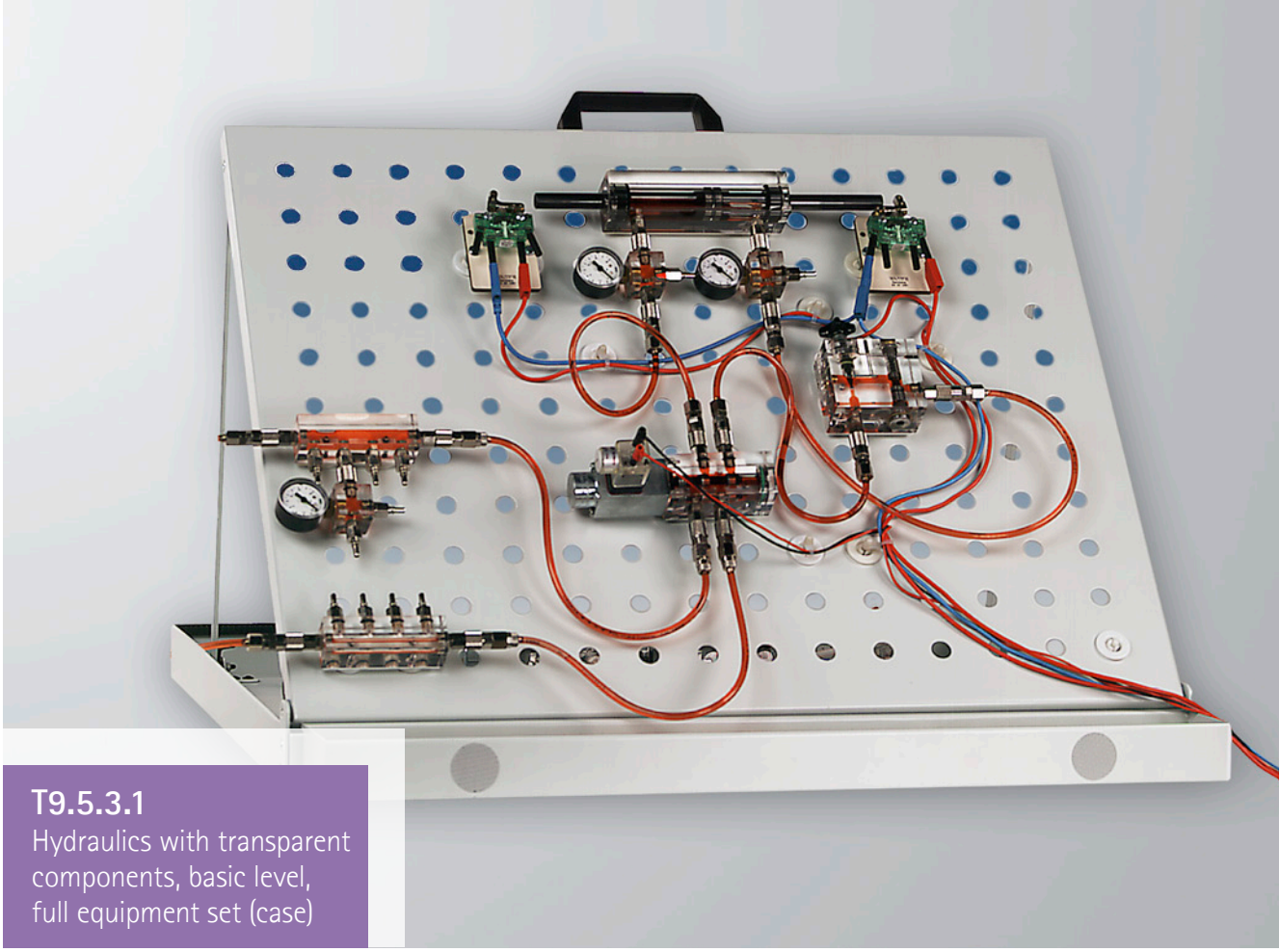
The course offers experiments at an intermediate and advanced level for vocational colleges and for Bachelor programmes.

Programming of automation systems is a prerequisite here.

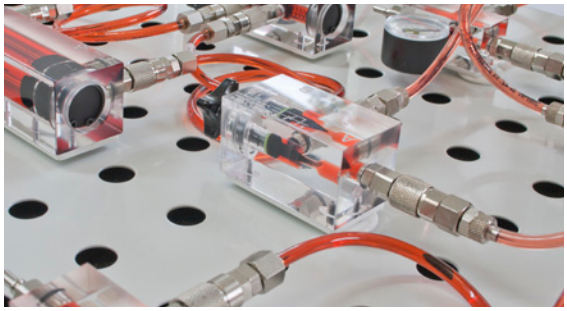
TOPICS:

- Provision of parts
- Separation of parts
- Transport of parts in linear form
- Transport of parts in circular form
- Transfer of parts between system parts
- Testing of parts
- Measurement of parts
- Sorting of parts
- Processing of parts
- Storage of parts





T9.5.3.1
Hydraulics with transparent components, basic level, full equipment set (case)



In this system the principles of hydraulics is primarily imparted.

LEARNING OBJECTIVES:

- Fundamental principles of hydraulics
- special functions of the components of the hydraulic system and their basic circuits

The hydraulic oil, coloured red for this purpose, and the white base plate increase the contrast between the outer housing and the internal parts. The maximum operating pressure of 10 bar allows the experiments to be performed safely. Thanks to the transparent connecting hoses and the additional introduction of air bubbles, the student can follow the flow paths completely from the pressure connector of the pump up to the tank connector. With this training system, the student is able to acquire the basic knowledge about hydraulics in three stages. The electrohydraulics system is designed to operate at 24 VDC, allowing even simple controllers to be realised under LOGO! and PLC.

LEARNING METHOD:

The student learns activity-oriented to practical and realistic examples with reference to the task from the literature. The base is handling apparatus, the determination of pressure, as well as the behavior of the hydraulic components in individual circuits.

TARGET GROUP:

Trainees in trade and industry with specialisation in mechanics, mechatronics, automotive and electrical engineering.

Students in Bachelor's programme as basic exercise.

TOPICS:

- Hydraulic aggregate
- Pressure limit
- Control valves
- Cylindery
- Current regulation valve
- Pressure regulation valve
- Characteristics of a valve-actuating magnet
- Signal storage by electrical latching

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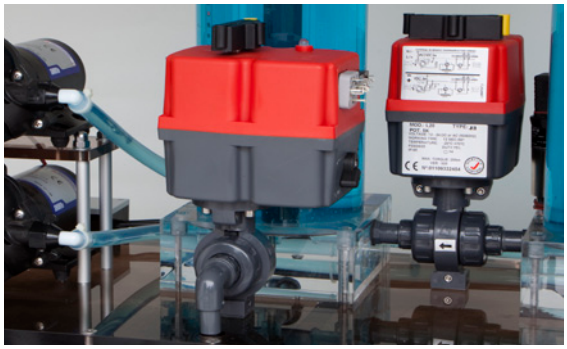
E6.2.4.1
AMIRA:
Three-Tank-System



The experiment comprises the mechanical setup of the non-linear controlled system "Three-Tank-System", the associated actuator and a connected controller, e.g. PC based.

LEARNING OBJECTIVES:

- Recording and evaluation of step responses
- Determination of the sensor or pump characteristics
- Realisation of simple filling level controllers
- Fault detection in multiple variable systems
- Non-linear system isolation and control
- Analysis of guide and interference response in the closed-loop control circuit

The system comprises three Plexiglass cylinders. These are connected in series via cylindrical connecting ducts.

The right external cylinder has a unique so-called nominal outflow duct. The liquid flowing out (usually distilled water) is collected in a collecting tank from which the two pumps are fed. For simulation of blockages or incorrect operations, all connecting ducts and the nominal outflow duct have manual valves enabling a closure of the corresponding duct.

Every tank has a further circular opening with connected manual valve for the simulation of leaks. The downstream pipe ends back in the collecting tank. Additional component faults such as pump defects, sensor failures or scaling of the sensor signals can be set at the actuator using potentiometers and switches.

LEARNING METHOD:

The students carry out the experiments according to the manual. The measurements and evaluation are advantageously carried out with the associated real-time PC controller program. A free demo program of the controller software is available to students so that the program operation or control of the measuring results can also be carried out remotely from the real controlled system.

TARGET GROUP:

The target group is students of control or automation technology at universities and universities of applied science. The laboratory experiment is also suitable as a laboratory device for research projects in the relevant fields.

The manual valves can optionally be replaced by electrical actuating valves. Suitable control electronics for the PC connection of the electrical actuating valves is optionally available for up to 6 valves.

For Master's theses or research studies and for assisting in the realisation of the students' own controller concepts, the C++ source code of the PC real-time controller is optionally available.

The laboratory experiment can be integrated in a MATLAB/Simulink environment without any problem using the optionally available PC plug-in card MF624. The controller design or the controller realisation in MATLAB/Simulink is typically implemented as part of Bachelor's or Master's theses at universities of applied science.

TOPICS:

- Fault response in case of a leakage current in Tank 2
- PI control of the isolated subsystems
- Determination of the characteristics and parameters
- Guide and fault response without PI control
- Guide response with PI control

E6.2.4.4
AMIRA:
Magnetic Suspension

The experiment comprises the mechanical setup of the non-linear controlled system "Magnetic Suspension", the associated actuator with integrated analogue controller and a connected controller, e.g. PC based.

LEARNING OBJECTIVES:

- Stability testing of the closed-loop control circuit using the root locus curve, Nyquist criterion and Bode diagram
- Recording step responses
- Working point setting for analogue controllers
- Experiments with analogue and digital PD-T1 or PID-T1 controller
- Visualization of the influence of the control parameters on the system performance (fault and setpoint step response)

The laboratory experiment "Magnetic Suspension MS40" embodies the technical realisation of a non-linear unstable single variable system. It comprises a freely suspended metal body and a solenoid as actuator and comprehensive controller electronics.

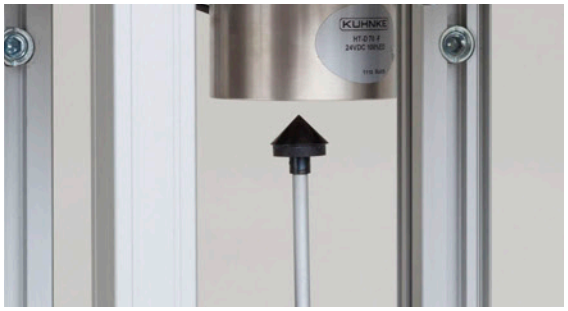
The non-linear, unstable controlled system is a freely suspended metal body that is held at the highest point by solenoids. The metal body position corresponding to the distance between the body and magnet is recorded with an inductive path sensor (LVDT) and communicated to the controller. The controller communicates the actuation signal to the actuator, which then initiates the desired position change. The setpoint position can be varied in the range from 0-5 mm.

LEARNING METHOD:

The students carry out the experiments according to the manual. The measurements

TOPICS:

- Stability testing with WOK and Bode diagram
- Working point setting of the analogue controller
- Change to the controller parameters and testing the system performance
- Comparison of analogue PID controllers with digital PID controller



and evaluation are advantageously carried out with the associated real-time PC controller program. A free demo program of the controller software is available to students so that the program operation or control of the measuring results can also be carried out remotely from the real controlled system.

TARGET GROUP:

The target group is students of control or automation technology at universities and universities of applied science. The laboratory experiment is also suitable for use in research projects in the relevant fields.

For Master's theses or research studies and for assisting in the realisation of the students' own controller concepts, the C++ source code of the PC real-time controller is optionally available.

The laboratory experiment can be integrated in a MATLAB/Simulink environment without any problem using the optionally available PC plug-in card MF624. The controller design or the controller realisation in MATLAB/Simulink is typically implemented as part of Bachelor's or Master's theses at universities of applied science.

E6.2.4.5
AMIRA:
Ball and Beam

The experiment comprises the mechanical setup of the non-linear controlled system "Ball and Beam", the associated actuator and a connected controller, e.g. PC based.

LEARNING OBJECTIVES:

- Modelling of the ball and beam system
- Closed-loop control synthesis in the state space
- Realisation of the state control
- Realisation of the fuzzy control
- State and interference variable observer

The non-linear controlled system comprises a ball located on a beam that can be changed to different angles. The ball can roll freely along the beam on a 1m section. The beam is driven by a DC motor via a toothed belt, a toothed lock washer and a coupling, so that the ball can be stabilised at a set location. The stabilisation of the ball is achieved by a digital controller generating an actuation signal from the measuring variables, which actuates the DC motor via an electronic actuator.

The ball beam position is determined via an incremental rotary encoder and the ball position is determined via a camera as measuring variables. The system is fully wired and is connected to the corresponding electronics via a plug-in connection. All moving parts are covered by transparent Plexiglass.

LEARNING METHOD:

No traineeship instructions have been formulated at present.

Normally, applications of the experiment are formulated for the relevant traineeship requirements at universities of applied science as part of Bachelor's or Master's theses. The measurements and evaluation are advantageously carried out with the associated real-time PC controller program. A free demo program of the controller software is available to students so that the program operation or control of the measuring results can also be carried out remotely from the real controlled system.

TARGET GROUP:

The target group is students of control or automation technology at universities and universities of applied science. The laboratory experiment is also suitable for use in research projects in the relevant fields.

A colour monitor is optionally available for displaying the camera image and for service purposes. The monitor is supplied with a power supply adapter and connecting cable for the actuator.

For Master's theses or research studies and for assisting in the realisation of the students' own controller concepts, the C++ source code of the PC real-time controller is optionally available.

The laboratory experiment can be integrated in a MATLAB/Simulink environment without any problem using the optionally available PC plug-in card MF624. The controller design or the controller realisation in MATLAB/Simulink is typically implemented as part of Bachelor's or Master's theses at universities of applied science.

TOPICS:

- System calibration
- Influence of various balls on the control
- Influence of fault variable compensation
- Changed pole specifications
- Changed feedback matrix

E6.2.4.7
AMIRA:
Inverted Pendulum

The experiment comprises the mechanical setup of the non-linear controlled system positioning system PC60 and the extension set "Inverted Pendulum", the associated actuator and a connected controller, e.g. PC based.

LEARNING OBJECTIVES:

- Linear system description in the state space
- State and fault variable observation
- Luenberger identity observer
- Recording and evaluation of step response

The basic system contains an actuator as well as the mechanics (PC60) with the pre-assembled mounting set of the pendulum mechanics (Opt. 60-20). The unstable controlled system comprises a pendulum that is mounted on a carriage so as to be rotating. The carriage is driven by a high-performance three-phase synchronous motor along a guide rod on a length of approx. 1.5 m via a toothed belt, toothed lock washer and coupling, so that the pendulum can be stabilised in a vertical position at a location that can be specified.

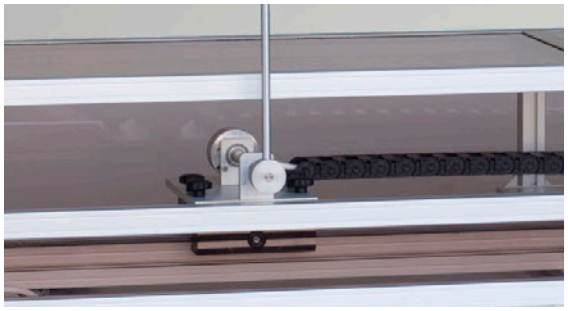
The stabilisation of the pendulum is achieved by a digital controller generating an actuation signal from the measuring variables, which actuates the synchronous motor integrated in the control electronics. The angle of the pendulum and the position of the carriage are determined as measuring variables via incremental encoders.

LEARNING METHOD:

The students carry out the experiments according to the manual. The measurements

TOPICS:

- Recording and evaluating the step response of the "Carriage" system
- Determination of integration and friction constants
- Calculation of the control and system matrix of the scanning system
- Calculation of the feedback matrix
- Calculation of the observer matrix
- Recording and evaluation of various measuring variables



and evaluation are advantageously carried out with the associated real-time PC controller program. A free demo program of the controller software is available to students so that the program operation or control of the measuring results can also be carried out remotely from the real controlled system.

TARGET GROUP:

The target group is students of control or automation technology at universities and universities of applied science. The laboratory experiment is also suitable for use in research projects in the relevant fields.

For Master's theses or research studies and for assisting in the realisation of the students' own controller concepts, the C++ source code of the PC real-time controller is optionally available.

The laboratory experiment can be integrated in a MATLAB/Simulink environment without any problem using the optionally available PC plug-in card MF624. The controller design or the controller realisation in MATLAB/Simulink is typically implemented as part of Bachelor's or Master's theses at universities of applied science.

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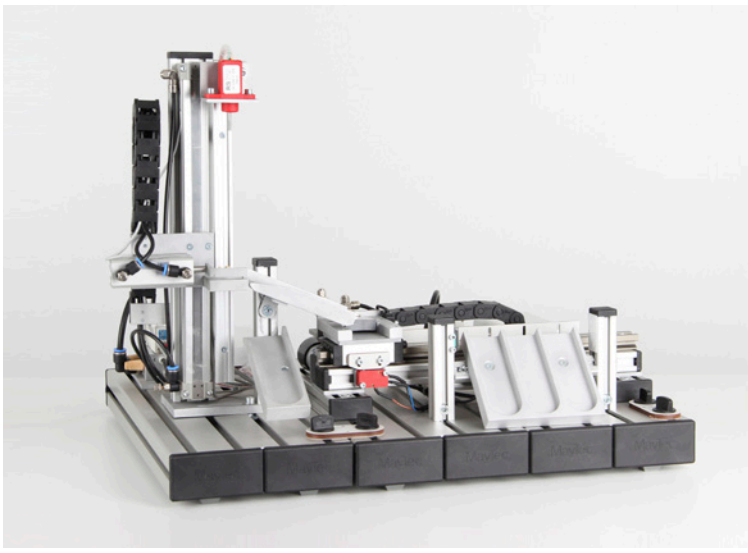

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