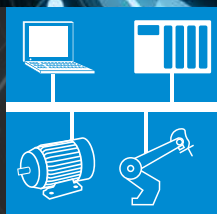


# AUTOMATION

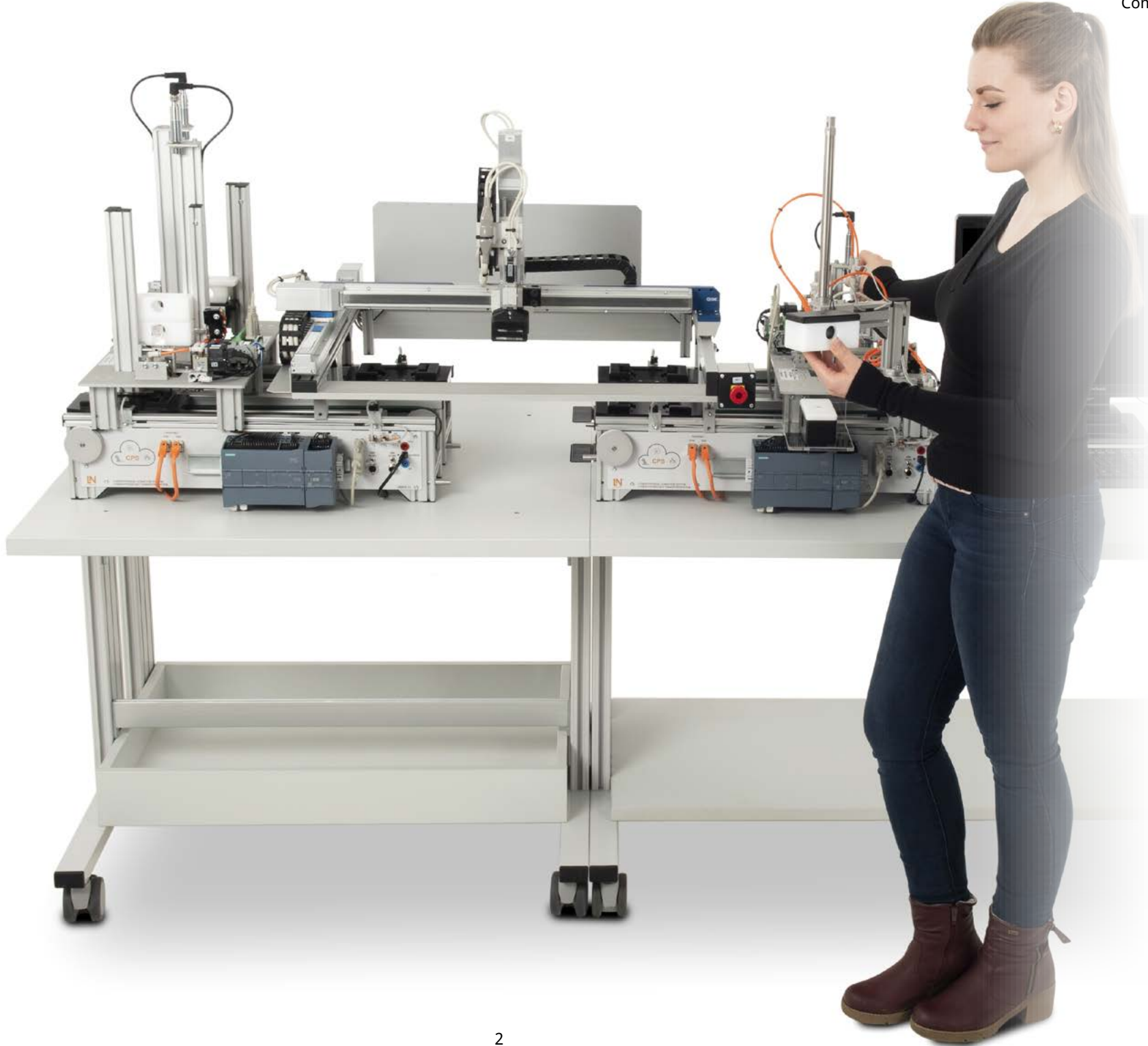


## TRAINING SYSTEMS FOR AUTOMATION TECHNOLOGY

**For acquiring practical and project-oriented skills  
and expertise**

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## QUALIFIED FOR INDUSTRY



### Training systems for automation technology

#### Technical progress...

Modern smart factories involve the meshing of production processes with the latest information and communications technology. This makes it possible to manufacture tailor-made products that match the customers' needs at inexpensive prices and in high quality. This concept is predicated on data acquisition pertaining to the status of the production system and the closed-loop control of process variables. This is accomplished using a wide variety of sensors that operate according to different physical principles. Knowledge of sensor systems is therefore essential for anyone dealing with automation or closed-loop control technology as well as for mechatronics technicians.

#### ... has a major impact on education and training

Changing demands call for new, modern, practice-oriented training systems. These systems instruct trainees on the most up-to-date technology and provide them with the requisite skills.

#### Strong partnership with industry

is the guarantee for close proximity to actual practice. Lucas-Nülle has found this strong partner in the market leader, Siemens AG. State-of-the-art products in automation engineering from Siemens are prepared by Lucas-Nülle for educational purposes and precisely tailored to the needs of schools and educational institutions. All areas and study levels are fully covered from the basic compact version up to and including modular high-end systems with fieldbus interfaces and decentralized peripherals including operating and monitoring equipment.

It goes without saying that the latest security and safety technology in accordance with the latest European engineering guidelines has been integrated into all of the systems.

The modular and scalable vocational training systems are both innovative and future-proof and thus form the foundation for excellent and indepth training in automation technology.

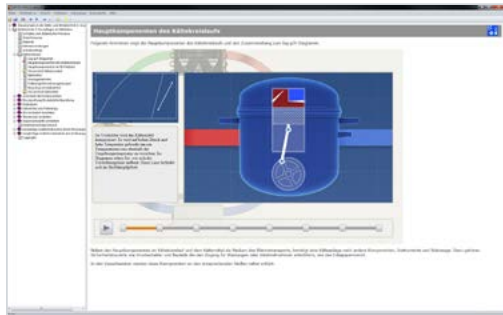


# UNITRAIN - DESIGNED TO MOTIVATE LEARNERS

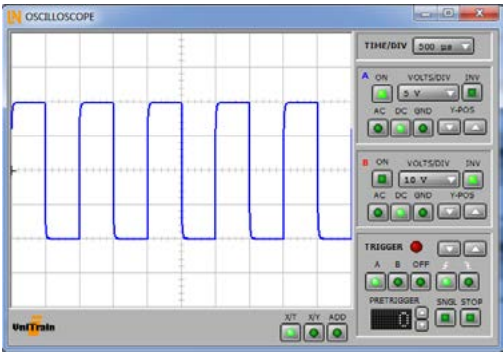
## A system for the entire scope of technical vocational training

Getting people the know-how and expertise to operate more and more complicated technical systems and equipment in ever shorter time frames is the big challenge facing the vocational training and education of today and tomorrow. It was to master this challenge that the UniTrain system was developed in the first place: a computer-based multimedia experiment and training system for electrical engineering and electronics.

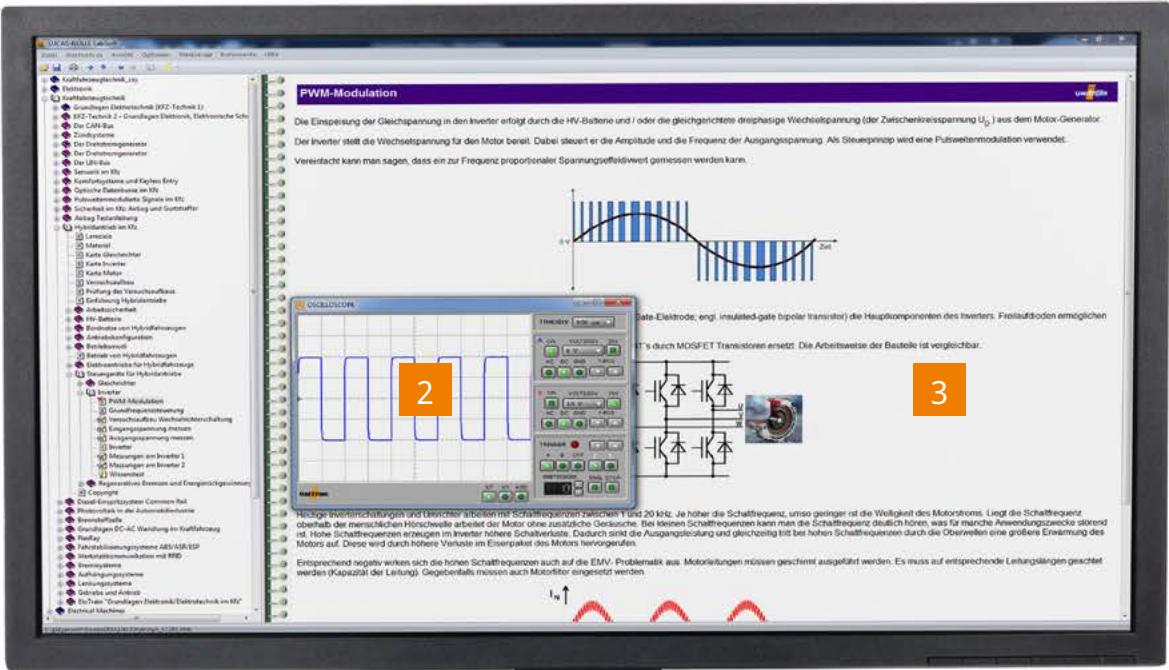
By integrating training programs with a fully equipped electrical laboratory into a single mobile interface permits theory and practice to be taught efficiently and effectively, anywhere and anytime.



NEW: Integrated WLAN module



2 Virtual instrument  
120 virtual instruments for interface control



3 LabSoft course  
Over 130 training programs with experiment hardware from all areas of electrical engineering and electronics

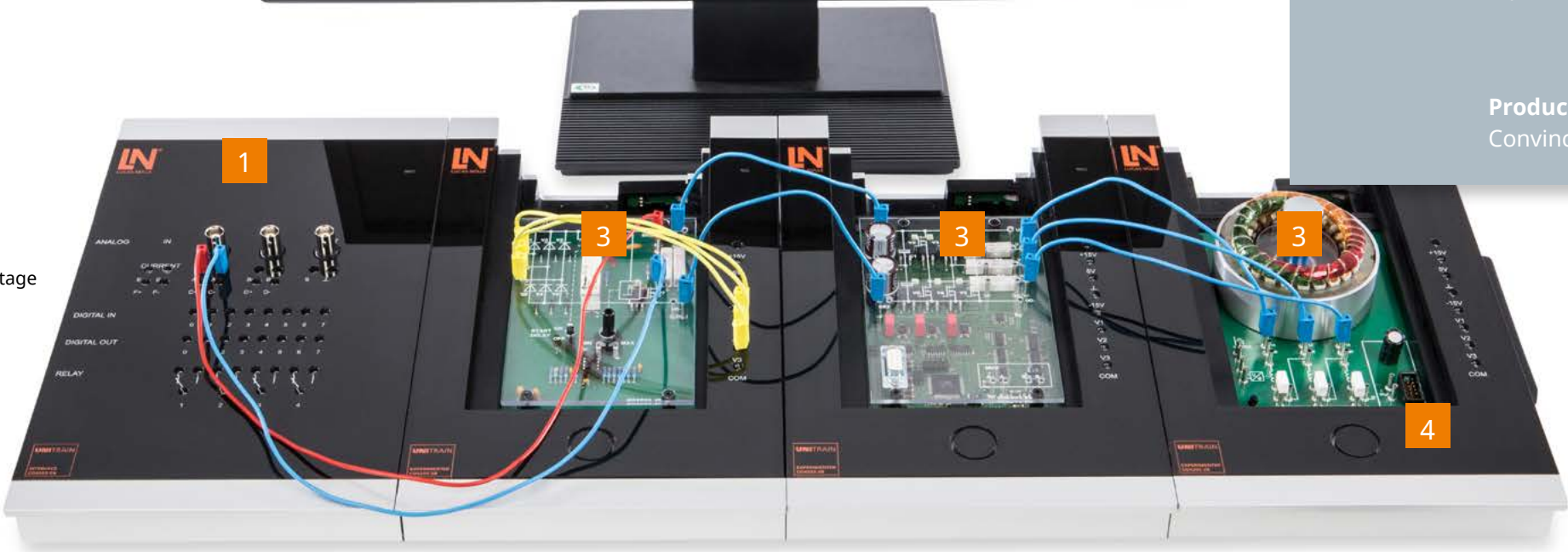
### Your benefits

- Universal training system
- Mobile deployment for use anywhere
- Promotes independent learning
- Building skills and expertise through practical experiments
- Alternating challenges boost motivation
- Safer experimentation thanks to safety extra-low voltage
- Learning programs combine theory and practice
- For the entire scope of electrical engineering

Product video  
Convince yourself of the benefits.



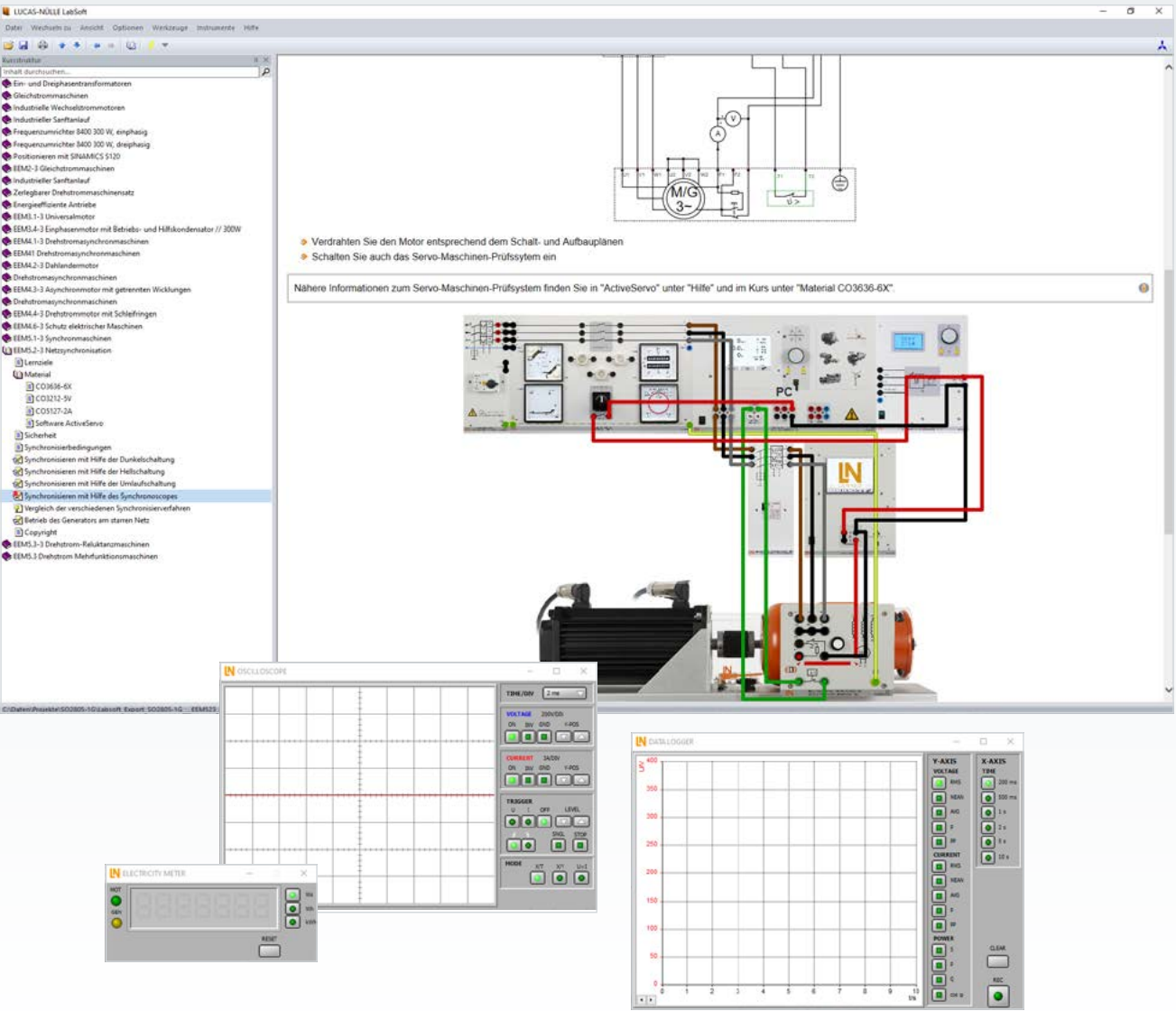
1 UniTrain interface  
Measurement and control interface:  
Analog/digital measurement inputs and voltage sources for the experiments



4 Experimenter  
Accommodates the experiment cards and additional voltage outputs (three-phase current)



# COMPUTER-BASED LEARNING PLATFORM



## Interactive Lab Assistant (ILA)

When performing the experiments, you are supported by an Interactive Lab Assistant (ILA). It not only guides you through the experiment but also provides valuable theoretical information, records measurement values, and all the while in the background it automatically creates the required laboratory documentation as a print or PDF document. If you wish to fine-tune the guiding instructions, simply use the Labsoft Classroom Manager to change or supplement the content.

## Benefits

- Teaching theory using easy-to-understand animations
- Support while performing the experiments
- Interactive demonstration of experiment set-ups
- Access to real measuring and testing equipment with comprehensive evaluation possibilities
- Practice-oriented project assignments
- Integrated operating instructions
- Documentation of the experiment results (compilation of an experiment report)
- Knowledge questions incl. feedback function

## The LabSoft Classroom Manager

is an administration software with extensive functionality. It permits practice-based teaching and learning processes to be organized and managed comfortably. The Classroom Manager is well suited for all LabSoft-based learning programs like ILA, UniTrain, InsTrain and CarTrain.

It consists of the following program elements:



### LabSoft Manager

Manage your LabSoft courses, students and learning groups using the LabSoft Manager. That way, the right learning material is always available for your students.



### LabSoft Questioner

Many question types are available in the LabSoft Questioner for the creation of queries, measurement exercises and test questions. These exercises and questions can be inserted into the courses and exams.



### LabSoft Editor

Numerous aids in the LabSoft Editor help you to create new courses and assist the user by guiding him step-by-step through the necessary instructions.



### LabSoft TestCreator

Tests are created which can be used to simultaneously assess both knowledge and skill level. Filter functions help you in selecting test questions both manually and automatically.



### LabSoft Reporter

Learning progress and test results are presented by the LabSoft Reporter. Numerous evaluations for individual and group results of courses and exams facilitate systematic monitoring and supervision.



### LabSoft ControlCenter

With the ControlCenter you are always up-to-date on everything in your classroom. It shows what your classroom is currently working on, inserts help questions and permits the distribution of individual screen content to the group.

# MORE THAN A LABORATORY



**Complex training content**  
presented vibrantly using modern learning media

**Flexible process engineering**  
production plants with IPA

**Every IPA station can be open- and closed-loop controlled** using an industrial PLC or the UniTrain

**Comprehensive solutions for process control systems:**  
PLC, AS-i, PROFIBUS, PROFINET, HMI, Remote Maintenance, Safety Technology, Drive Technology

A multitude of process control assignments are provided by the plant system models and process simulators

**CNC programming**  
directly on lathe and milling machines or simulated in 3D

**Smart factory (Industry 4.0) with IMS®**

**Blended Learning**  
Multimedia-based teaching of know-how with UniTrain



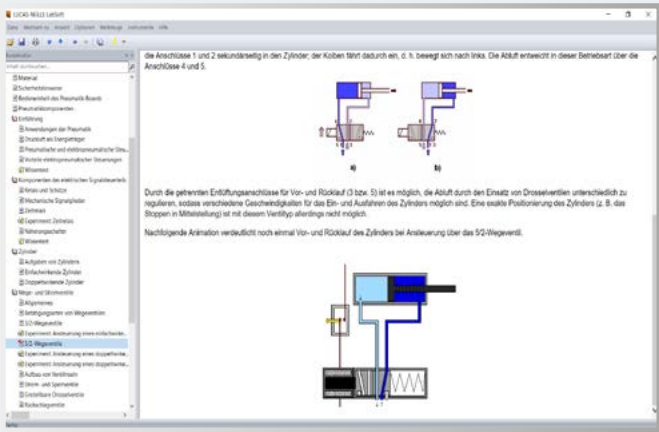
# FUNDAMENTALS FOR AUTOMATION TECHNOLOGY

A group of five students are working in a laboratory setting. In the foreground, a woman with glasses and a red sweater is looking at a tablet. Behind her, a man in a white shirt is also looking at the tablet. To the right, another man in a blue sweater is working on a piece of electronic equipment with yellow cables. In the background, a woman in a grey sweater and a man in a grey hoodie are looking at a computer monitor. The lab is equipped with various electronic components, cables, and computer monitors displaying technical diagrams and code.

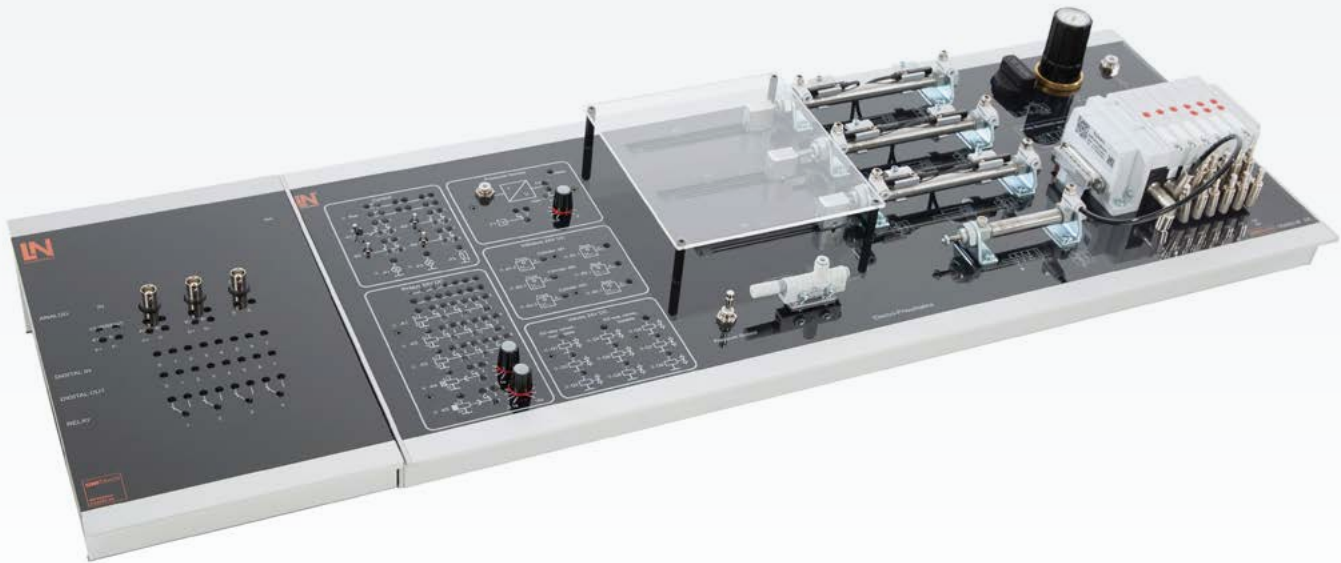
Thanks to the progress being made in industrial process automation, the area of automation technology is becoming ever more important. This dovetails into other areas like drive technology, closed-loop control and IT technology. Due to rapid rates of development, automation technology is one of the most innovative and short-lived areas in all electrical engineering.



# PNEUMATICS /ELECTRO-PNEUMATICS



Pneumatics CO4204-5E



UNITRAIN  
SYSTEM

## Pneumatics for vocational training and education

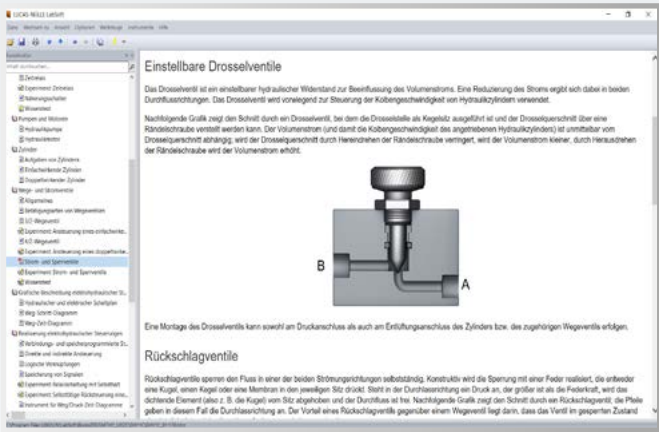
The course teaches the basics of pneumatics. In all hands-on project assignments, the core skills and technical qualifications are imparted on the basis of integrated and independent planning, implementation and inspection. A wide scope of vocations should be covered by a basic training program that teaches hands-on skills and expertise. To be able to do skilled and professional work, the students especially need to learn how to carry out independent planning, implementation and inspection and also how to conduct themselves professionally in a business environment.

## Training contents

- Fundamentals of pneumatics
- How single-acting and double-acting cylinders function
- Becoming familiar with various directional valves
- How electropneumatic controls are designed and function
- Hard-wired controls
- Programmable controls
- Recording time-displacement diagrams
- Time-dependent controls

Art. no. CO4205-5E / -5F

# HYDRAULICS /ELECTRO-HYDRAULICS



UNITRAIN  
SYSTEM

## Hydraulics for vocational training and education

Thanks to leak-free connecting hoses, it is possible to do safe and clean work in the classroom even at pressures of up to 40 bar. The accompanying UniTrain self-learning course guides the students through all of the basic hydraulic principles. They design logic operations using the circuit diagram editor integrated into the software or carry out the traditional wiring required for the projects using the control elements integrated into the board.

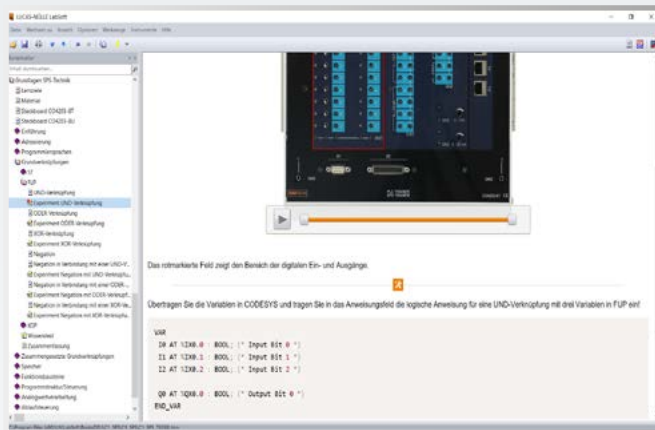
## Training contents

- Fundamentals of hydraulics/electro-hydraulics
- Hydraulic and electrical circuit diagrams
- Single-action and double-action cylinders
- Extension of a cylinder using a pushbutton
- Extension of a cylinder with self-holding function
- Limit switch as n.c. contact
- Feed control with start precondition
- Start interlocking with random intermediate stop
- Pressure-dependent control
- Mechanical interlocking of a pushbutton contact
- Electrical interlocking of a pushbutton contact
- Rapid feed circuit
- Time-dependent control
- Recording time-displacement diagrams

Art. no. CO4205-8A / -8B



# FUNDAMENTALS OF PLC TECHNOLOGY



**UNITRAIN  
SYSTEM**

## Programmable logic control (PLC)

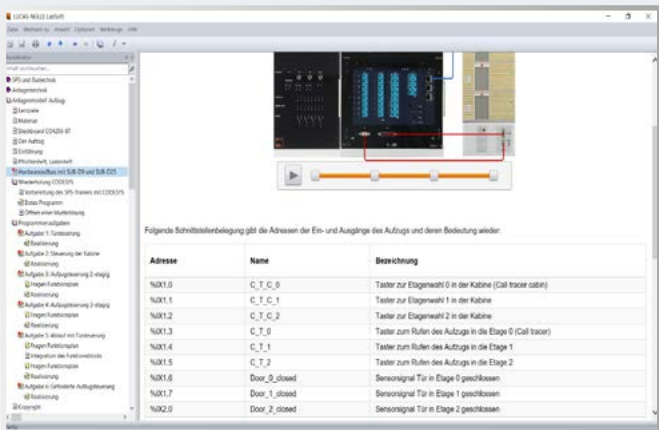
Today's highly automated industrial landscape features machinery that practically operates by itself. As a rule, the plants and systems are operated by programmable logic control units or PLCs. An understanding of how these controls operate and are networked is imperative. Students and trainees gain more than just an introduction into this subject using the PLC basics board which is manufacturer-neutral.

## Training contents

- Basic principles and terminology for PLCs
- Design and operation
- Logic operations, memory functions, time and counter functions, analog value processing
- Project planning of an automation system
- Programming to IEC 1131 using structured text (ST), function block diagrams (FBD) or ladder diagrams (LD)
- Combination of basic operations
- Project planning in digital technology
- Project planning in traffic light control
- Project planning in analog value processing
- Project planning in 7-segment displays

Art. no. CO4204-8M

# PLC SYSTEMS MODEL



**UNITRAIN  
SYSTEM**

## Practical hands-on approach to PLC

With this compact learning system, the logical operating sequence of a lift can be learned and programmed. Thanks to the very realistic depiction of the entire lift system, the student quickly grasps the various processes. The use of industrial components is an orientation aid that helps students quickly find their way later on the job.

## Training contents

- Manual process control of motors
- Detecting sensor signals
- Lift control for two storeys
- Lift control for three storeys
- Lift control with door control operation
- Learning and programming EMERGENCY stop functionality

Art. no. CO4204-8T



# PROGRAMMABLE LOGIC CONTROL

Integral element of automation technology  
New priorities in training and education require new skills and qualifications in the disciplines of process control technology, electromechanics, electronics and computer-assisted control units (PLC).  
The fundamental principles and operations of the PLC are graphically illustrated with many examples, explanations and practical exercises.



# TRAINING SYSTEM FOR PROGRAMMABLE LOGIC CONTROL (PLC) S7-1516



## The training system for the 1500 series of control units

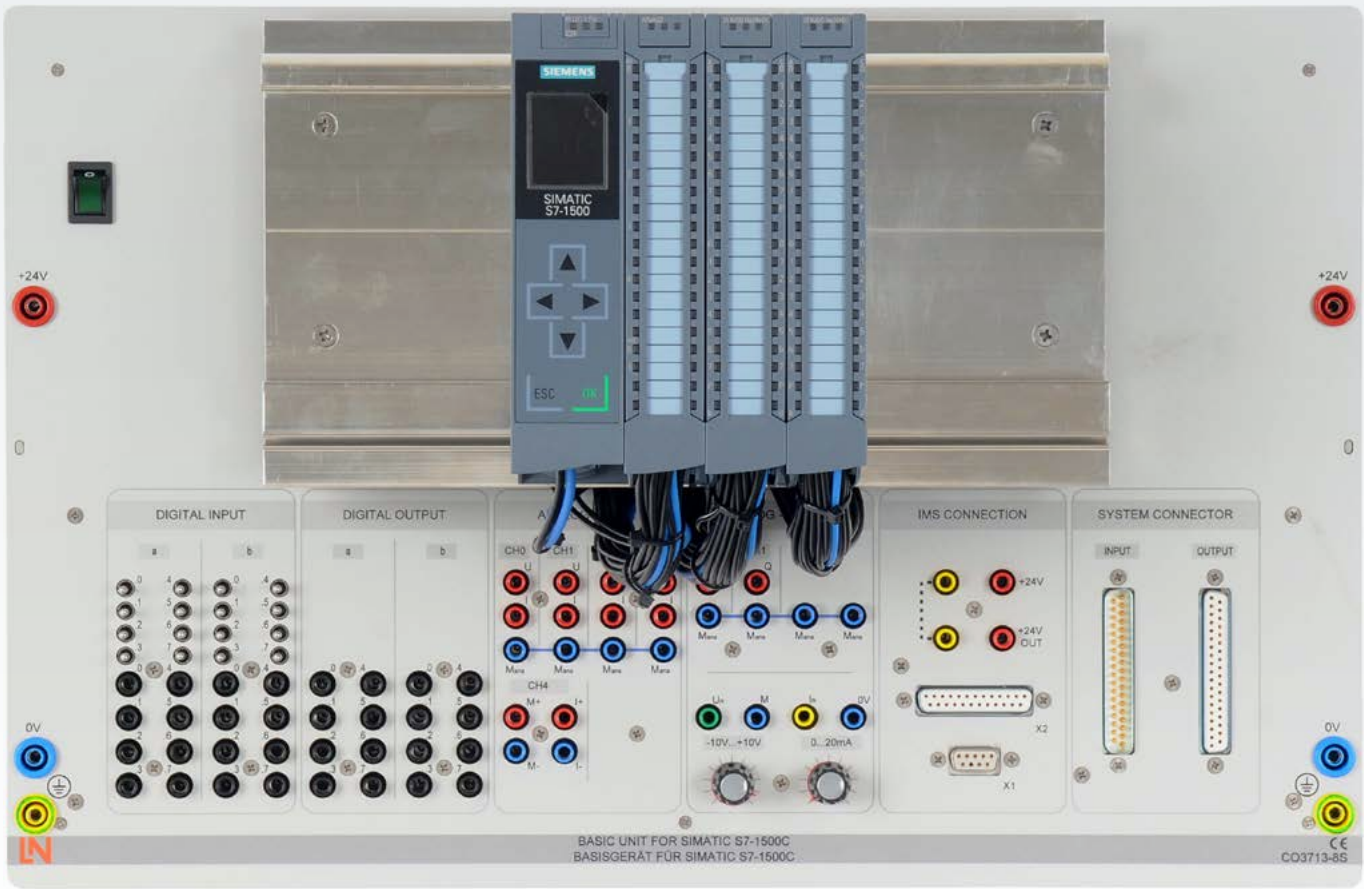
Training system for PLC devices of the SIMATIC S7-1500 series. Alternatively an S7-1512C or an S7-1516 unit can be used. The freely accessible profile rail is equipped with input and output modules of the SIMATIC S7-1500 series. The 4 digital input and output bytes are distributed with 2 bytes each on the 4mm-safety sockets and the 9-pin, 25-pin and 37-pin system connector plug-sockets.

Art. no. CLC15 PLC with S7-1516

## Technical data

- 16 digital inputs DC 24 V on 4 mm safety sockets
- 16 pushbutton/latching switches for simulation of digital inputs
- 16 digital outputs DC 24 V on 4 mm safety sockets
- 16 digital inputs DC 24 V via 9-pin, 25-pin and 37-pin system connector plug
- 16 digital outputs DC 24 V via 9-pin, 25-pin and 37-pin system connector plug
- 8 analog inputs -10 V ... +10 V and 0 ... 20 mA
- 4 analog outputs selectable -10 V ... +10 V or 0...20 mA
- 1 analog output with -10 V ... +10 V can be set via potentiometer
- Analog output with 0 ... 20 mA can be set via potentiometer
- 9-pin and 25-pin sockets for direct control of the mechatronic systems
- 37-pin connector plug and 37-pin socket

# S7-1512C SPS



## The training system for 1512C control

Training system for PLC units of the SIMATIC S7-1500 compact series. In contrast to the S7-1516, the S7-1512C compact control unit is only equipped with Profinet. Here we dispense with the Profibus since modern production plants nowadays largely use Profinet as the bus system.

Art. no. CLC15 SPS with S7-1512C

## Technical data

- 16 digital inputs DC 24 V on 4 mm safety sockets
- 16 pushbutton/latching switches for simulation of digital inputs
- 16 digital outputs DC 24 V on 4 mm safety sockets
- 16 digital inputs DC 24 V via 9-pin, 25-pin and 37-pin system connector plug
- 16 digital outputs DC 24 V via 9-pin, 25-pin and 37-pin system connector plug
- 5 analog inputs -10 V ... +10 V and 0 ... 20 mA
- 2 analog outputs selectable -10 V ... +10 V or 0...20 mA
- 1 analog output with -10 V ... +10 V can be set via potentiometer
- 1 analog output with 0 ... 20 mA can be set via potentiometer
- 9-pin and 25-pin sockets for direct control of mechatronic systems
- 37-pin connector plug and 37-pin socket



# TRAINING SYSTEM ON PROGRAMMABLE LOGIC CONTROL (PLC) S7-1215C



### An overview of the S7-1200 training system

The basic unit is equipped with a SIMATIC S7-1200, a KTP700 touchpanel and a power supply unit and thus forms a fully operational standalone, compact and expandable training system. The KTP700 touchpanel is equipped with an Ethernet interface for communication and programming. The networking of all equipment is easy to configure with the five-fold Ethernet switch.

### Benefits

- SIMATIC S7-1200 with CPU 1215C DC/DC/DC
- Solid desktop housing with non-skid feet
- Integrated power supply: 24V/5A DC
- Sockets for EMERGENCY-OFF loop (voltage disabling circuit for the output modules)
- Integrated touchpanel
- 5-fold Ethernet switch to network the PLC using the KTP700
- 9-pin and 25-pin sockets for direct evaluation of mechatronic systems
- Can be extended as desired using PROFIBUS or AS-i master module

Art. no. CLC12 PLC with S7-1200 and KTP700



### Automation visualization

Using the touchpanels KTP700 and TP700 it is easy to display entire applications or just signals. Control mechanisms such as buttons or switches complete all requirements for the operating and monitoring features.

### Benefits

- The programming of TP700 is performed with the WinCC Advanced visualization software included in the delivery
- Fully graphic colour display (16 million colours)
- Touchscreen 7"
- Resolution: 800 x 480 pixels
- PROFIBUS DP, PROFINET I/O, USB ports
- Disturbance and operating signal display
- Formulation management
- High viewing angle
- Dimmable LED background lighting from 0 ... 100 %

Art. no. CO3713-4P / -4Q



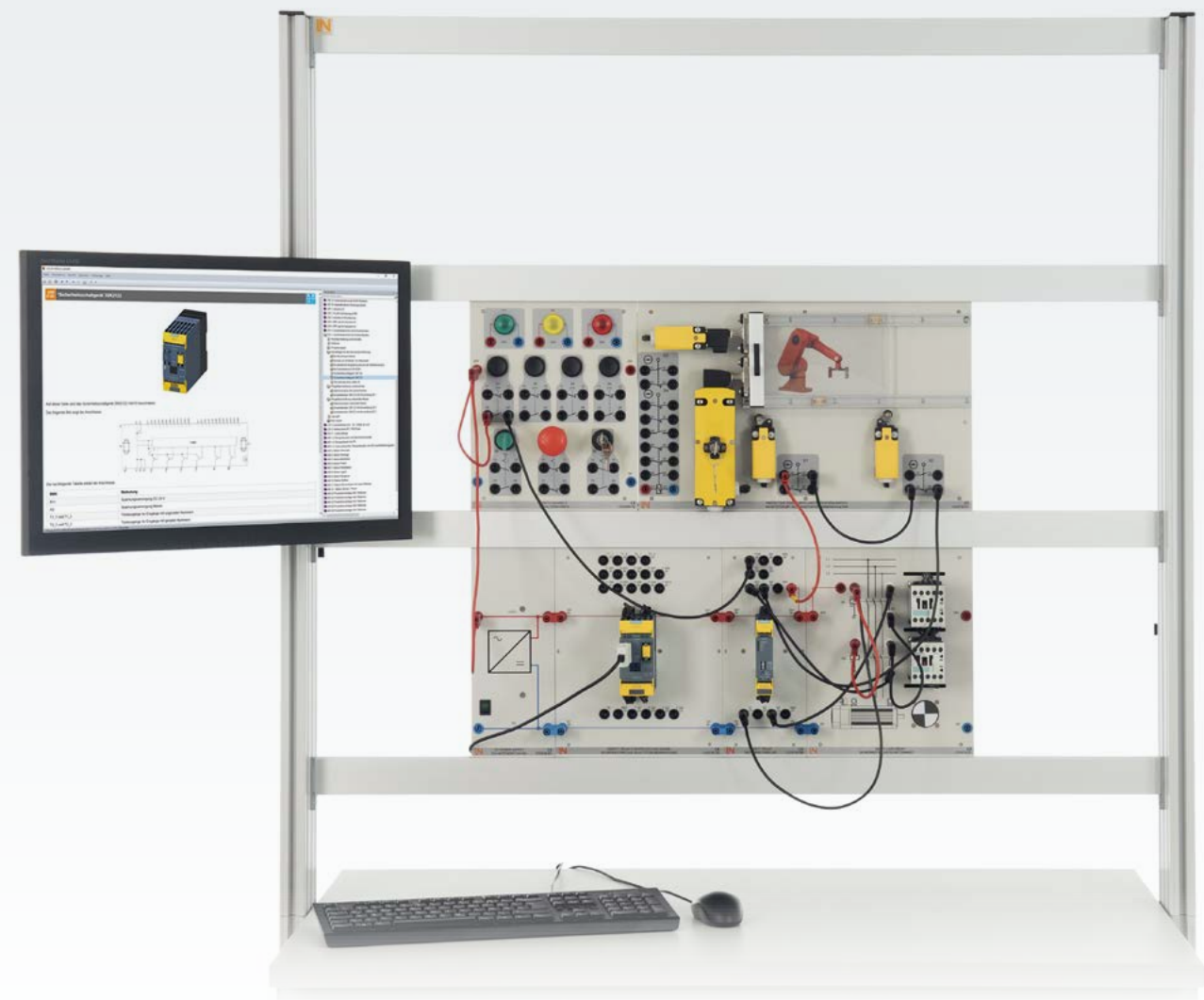
# SAFETY TECHNOLOGY IN THE AREA OF AUTOMATION ENGINEERING

A close-up photograph of a human hand hovering just above a red emergency stop button. The button is mounted on a yellow base and is located on a light blue surface. The background is blurred, showing what appears to be a workshop or laboratory setting with various equipment and papers.

The training systems covering the subject of "Safety and security technology" span the entire spectrum. Optical systems, like light barriers or laser scanners, can easily be integrated into these systems. The featured model is the safety door with a safety position switch which can be used to teach the widest range of safety applications. The systems covering safety technology are the perfect complement to the "Industrial Mechatronics System" IMS®.



# CIRCUITRY WITH SAFETY RELAYS



## Fundamental principles: safety with contactors

The featured model is the safety door equipped with a safety position switch. A variety of safety applications can be trained on this component using the corresponding safety circuits.

- Safety position switch with roller lever switch
- Safety position switch with locking mechanism
- Safety position switch with separate actuator
- Emergency shut-down circuit

## Benefits

- Safety categories according to EN 954-1
- Redundant design of safety circuitry
- Signalling system operating states
- Configuration and putting into operation of safety switching equipment
- EMERGENCY STOP
- Direct disabling with safety door locking mechanism

# CYBERSECURITY



## Cybersecurity in automation engineering

In modern production lines, the topic of cybersecurity is indispensable. All conventional security measures used to ward off cyberattacks on automation systems are imparted using a host of exercises.

## Training contents

- Rules and regulations governing system use
- Physical security measures
- Configuration of a security LAN router
- DHCP server
- Firewall
- Open VPN
- Analyse network protocols
- Secure Shell (SSH)
- HTTP(S)
- Remote maintenance with Sinema
- Access Control / Access Restriction
- Authentication / Release
- Encryption
- Certificates

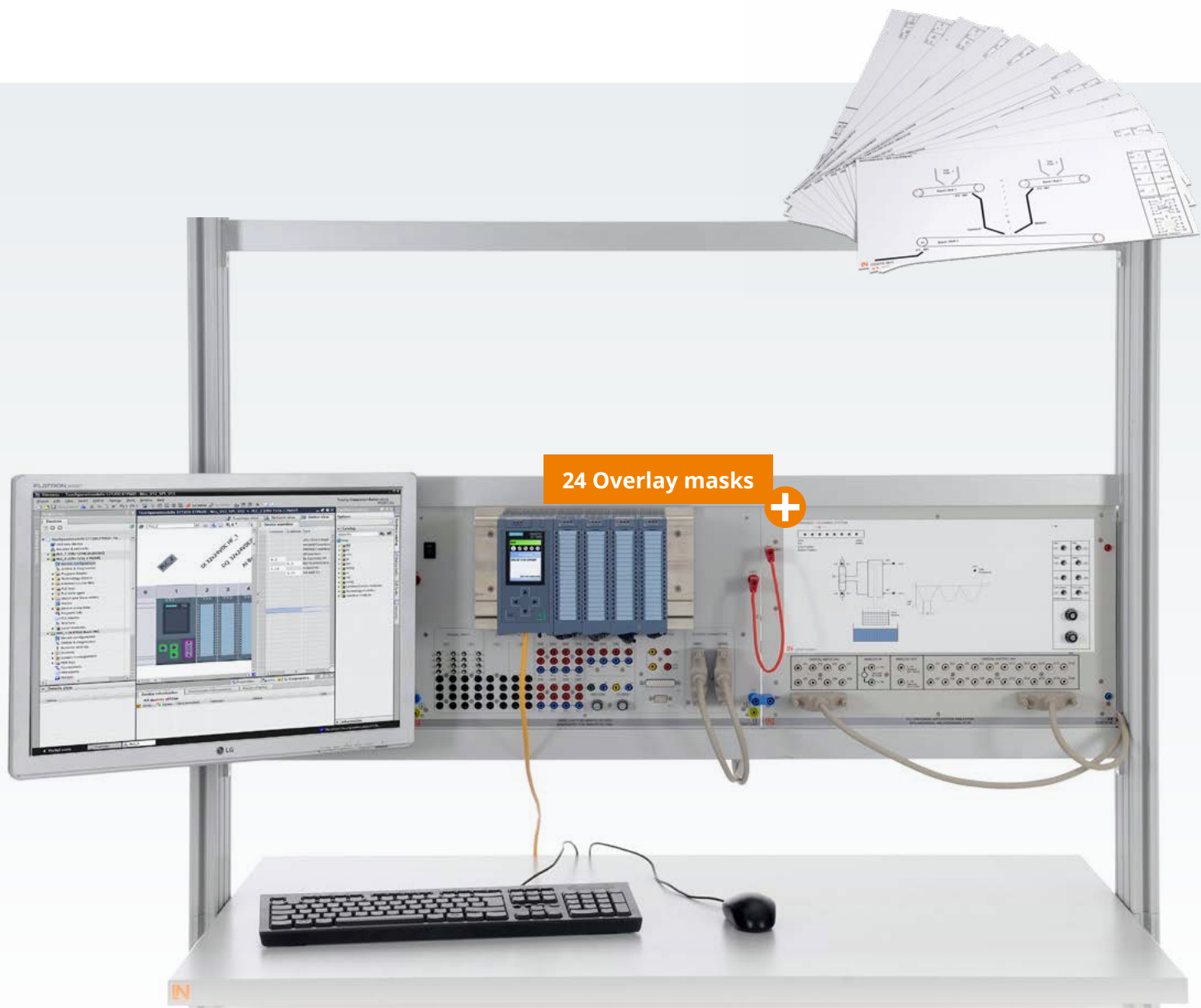


# AUTOMATION TECHNOLOGY APPLICATIONS

The application areas of automation technology are wide-ranging and almost ubiquitous. Whether it is about the networking of systems with different bus systems or applications like lifts or gantry robots, automation technology is playing an ever more important role.



# PLC UNIVERSAL PLANT SYSTEM SIMULATOR



### Set up, switch on and practice

The PLC universal plant system simulator was specifically developed for basic training in PLC technology. It is particularly well-suited to illustrate and practically demonstrate open- and closed-loop control processes in industrial applications. By using an array of overlay masks, up to 24 different technical processes and models can be simulated. The projects are designed to mirror teaching syllabuses and requirements.

### Projects

- Construction site traffic light
- Star-delta starting
- Dahlander circuit
- Start control
- Monitoring installation
- Tank filling system
- Flood gate control
- Transfer platform
- Buffer storage tank
- Filling level controlled system
- Mixing system
- and much more

# PLC TOUCHPANEL MODELS



### 8 models as an introduction to the TIA portal

The touchpanel models have been designed to include the basic functionality of PLC programming. A self-learning course takes the user from programming the data block to state and step sequence programming all the way to controller design. The models are shown in animated form on a touchpanel and control is carried out using the digital I/Os of the connected PLC. Just like in real models, the programmer also receives signals from sensors that are needed for further signal processing of the sequential steps.

### Projects

- Transport crane
- Construction site traffic light
- Tank filling system
- Conveyor belt
- 3-storey lift
- Start-delta starter
- Two-line 7-segment display
- Automatic room temperature control



# IO LINK



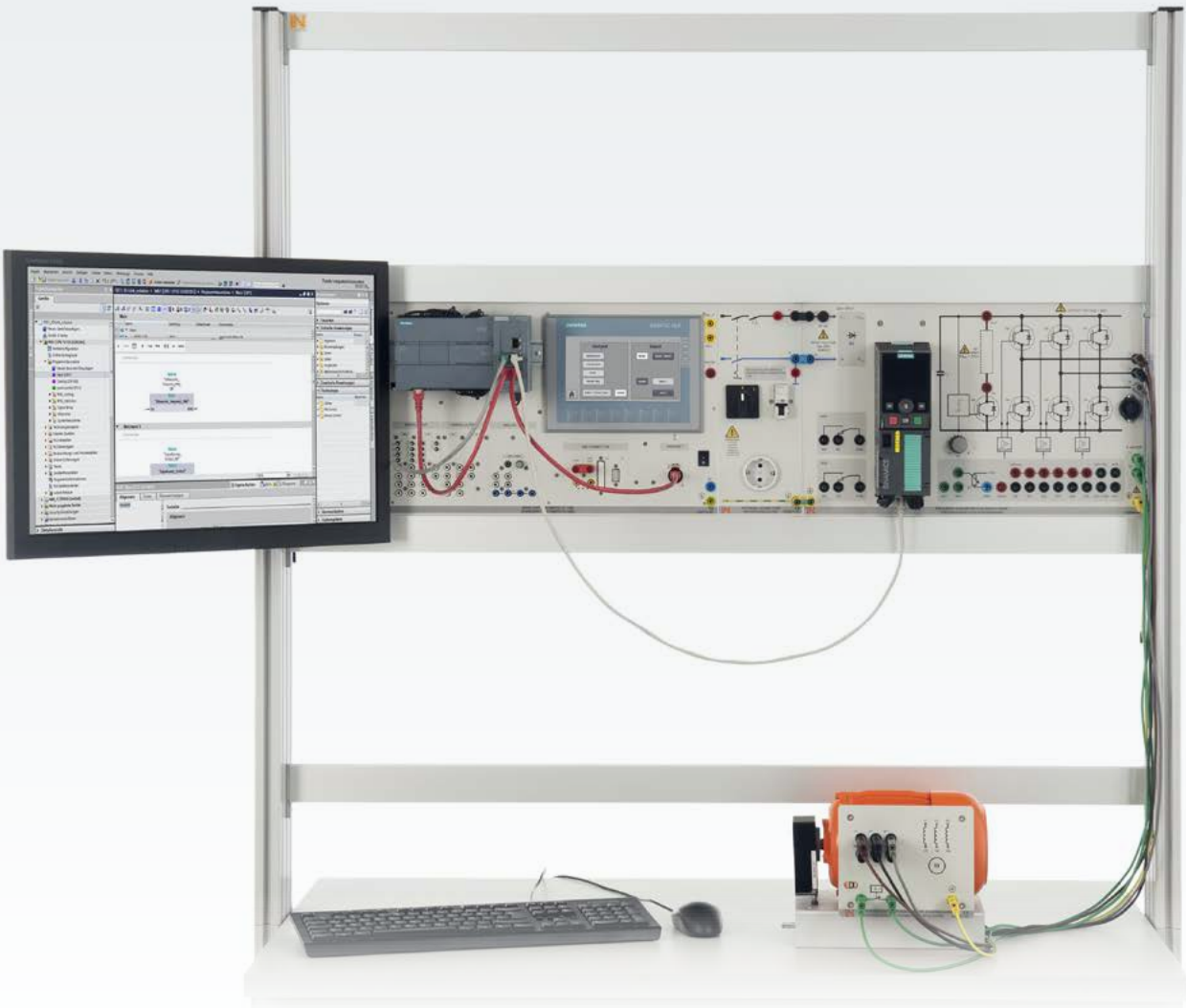
### IO link in manufacturing

IO link is an internationally standardized IO technology (IEC 61131-9) used to permit sensors and actuators to communicate. This technology makes "smart sensor technology" possible. The potential for IO link applications is vast and plays a huge role in the smart factory and the 4th industrial revolution.

### Training contents

- IO link fundamentals
- Transport system with IO link master
- Configuration in the TIA portal
- IO link RFID
  - ' Configuration
  - ' Package sorting project
  - ' Statistical compilation project
- IO link ultrasonic sensor
  - ' Position determination project
  - ' Segmentation project
  - ' Diagnostics project
- IO link signal lighting
  - ' Status display project

# OPEN-LOOP CONTROL OF ELECTRICAL DRIVE SYSTEMS



### Connection between drive and automation technology

The focus of this training system is on project planning and programming of the PLC and includes the operator panel as well as configuring and putting into operation of the frequency converter with PROFIBUS-DP. The servo brake unit is used in this training system for the purpose of loading the drive machine controlled by the frequency converter. This permits a variety of configurable driven machines like ventilators, winding drives, calendar units, compressors and a flywheel to be simulated.

### Training contents

- Configuring, programming and putting into operation a programmable logic control system
- Project planning and putting into operation a touchpanel
- Configuring and putting into operation a frequency converter
- Project planning and putting into operation a fieldbus system
- Networking the frequency converter with the control unit via PROFINET



# FUNDAMENTAL PRINCIPLES OF GANTRY ROBOT



The gantry robot is designed to perform "Pick&Place" operations or even warehouse storage tasks with workpieces. Additional operations like stacking workpieces, warehousing, traversing track contours and much more are also possible. With the aid of the pen holder, it is possible to attach pens and draw figures or trace contours used for simulating lathing.

### Training contents

- Basic principles for performing experiments
- Detailed experiment description
- Hardware configuration
- Projects:
  - ' Axis control in manual operating mode
  - ' Incremental movements
  - ' Convey workpieces
  - ' Stack workpieces
  - ' Circular track mode
  - ' Warehouse management

# AUGMENTED REALITY (AR) WITH THE IMS FACTORY APP



### AR in production processes

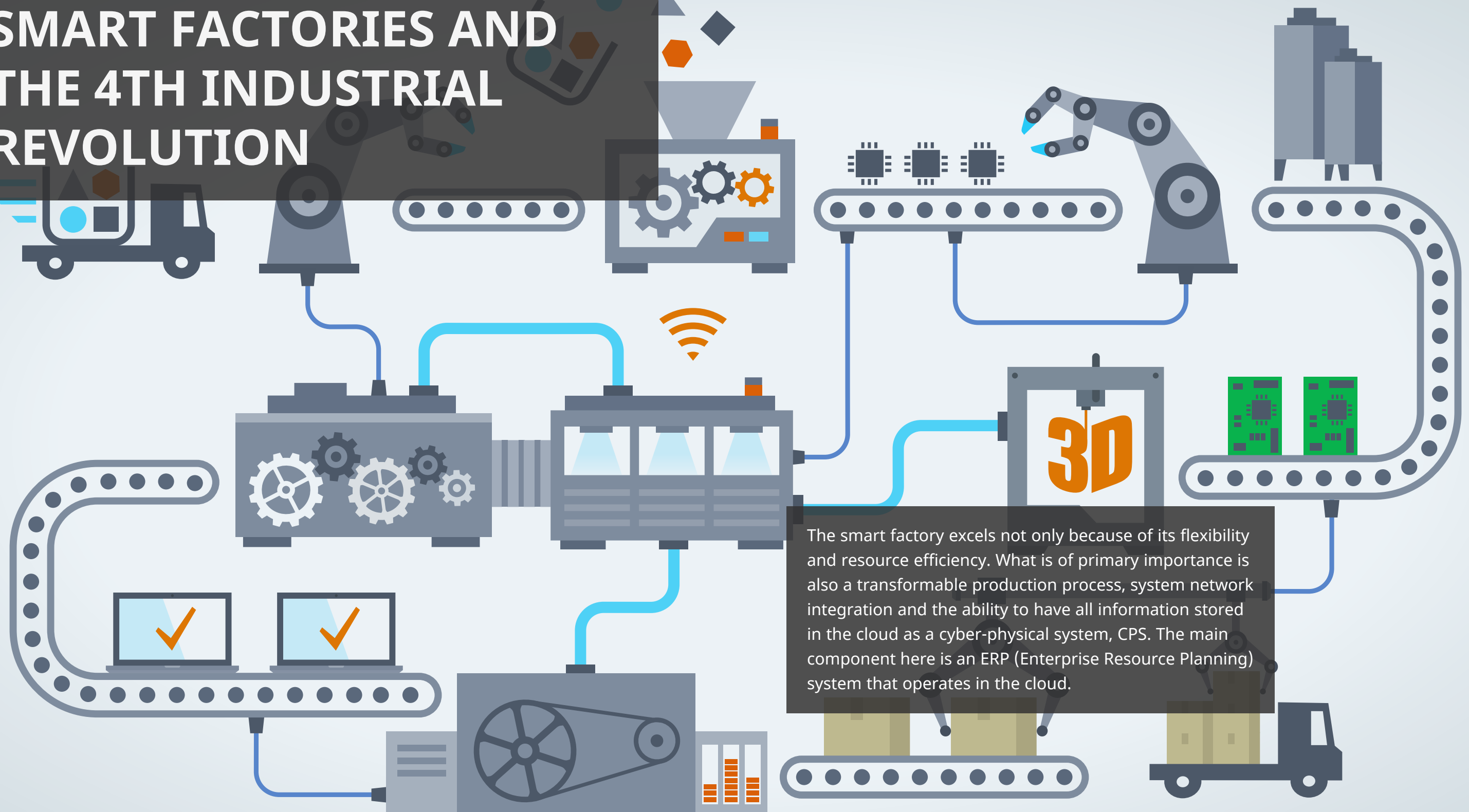
In the age of the smart factory, the 4th industrial revolution and ever greater advances in technology, it is also imperative to have upgrades in the area of maintenance. It must also be possible to use new technologies to not only monitor manufacturing but also to manually intervene and control processes.

### Training contents

- Introduction to augmented reality
- Communication between PLC and AR app
- Display of the signal states in real time
- Hardware control via app
- Discretionary positioning of the signals in the AR environment
- Configuration of error messages
- PLC signals available for free use also for other applications

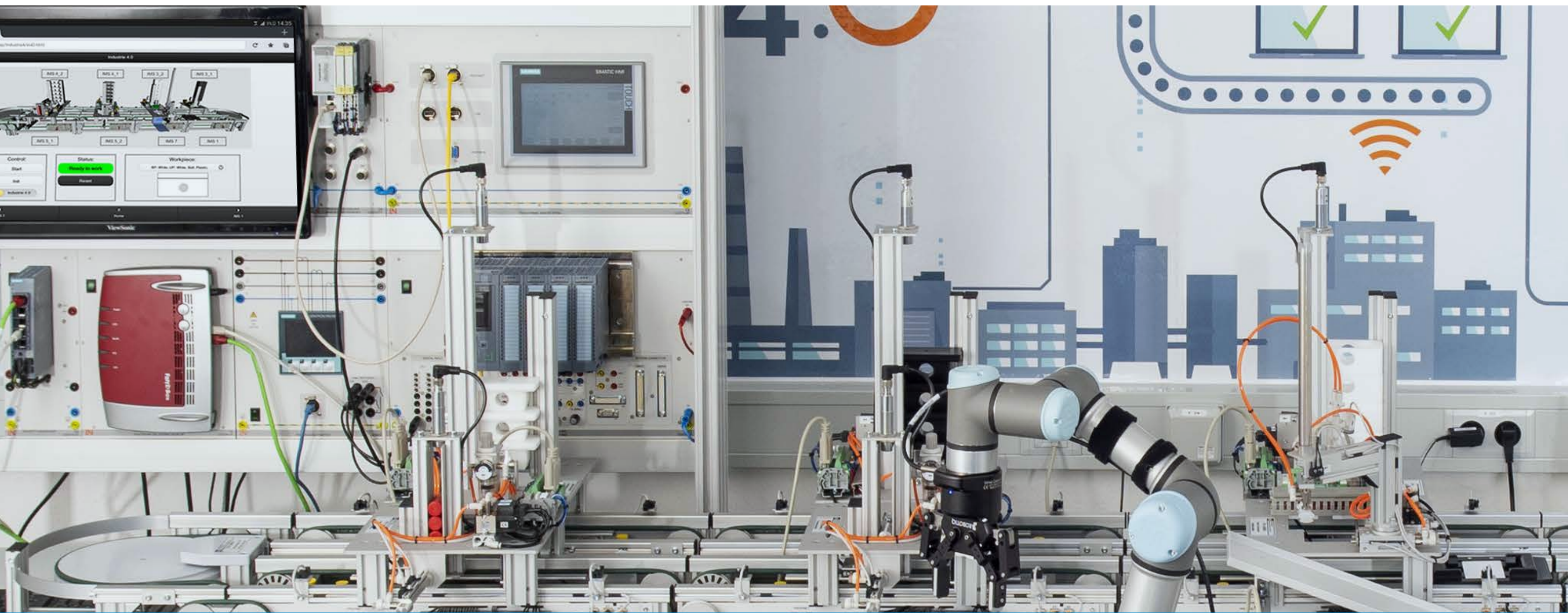


# SMART FACTORIES AND THE 4TH INDUSTRIAL REVOLUTION





# SMART FACTORY FOR VOCATIONAL TRAINING AND EDUCATION



## One system - many possibilities

In the basic equipment set of the smart factory (Industry 4.0), many variants of a product can be customized. By adding the MES and ERP systems to the equipment set, this system excels by ultimately demonstrating the difference to Industry 3.0.

## From subsystem to industrial production line

In the area of vocational and advanced training, it can be a long and painful process to start with a complex production line. This is avoided by our modular system with its eight individual, standalone stations that can be connected up and networked together with the ERP lab to make up a smart factory.

## Extension options

Thanks to its modularity, the system can be expanded to meet any needs in a flexible manner. Whether the system is meant to cooperate with an automated vehicle system (AVS), integrated into an Augmented Reality (AR) environment or used with a smart manual workstation to boost the number of product versions, there is no limit to the system's complexity.

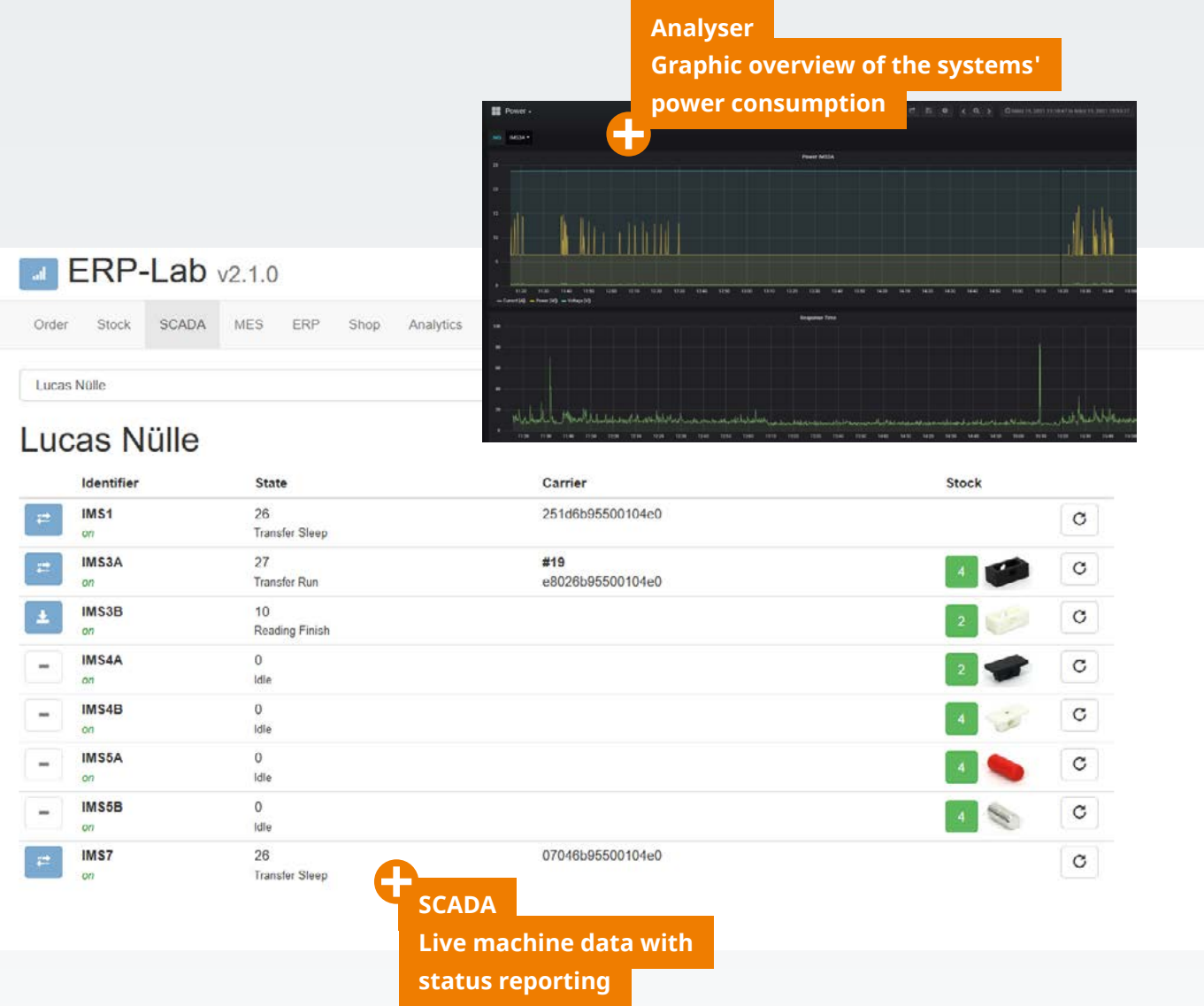
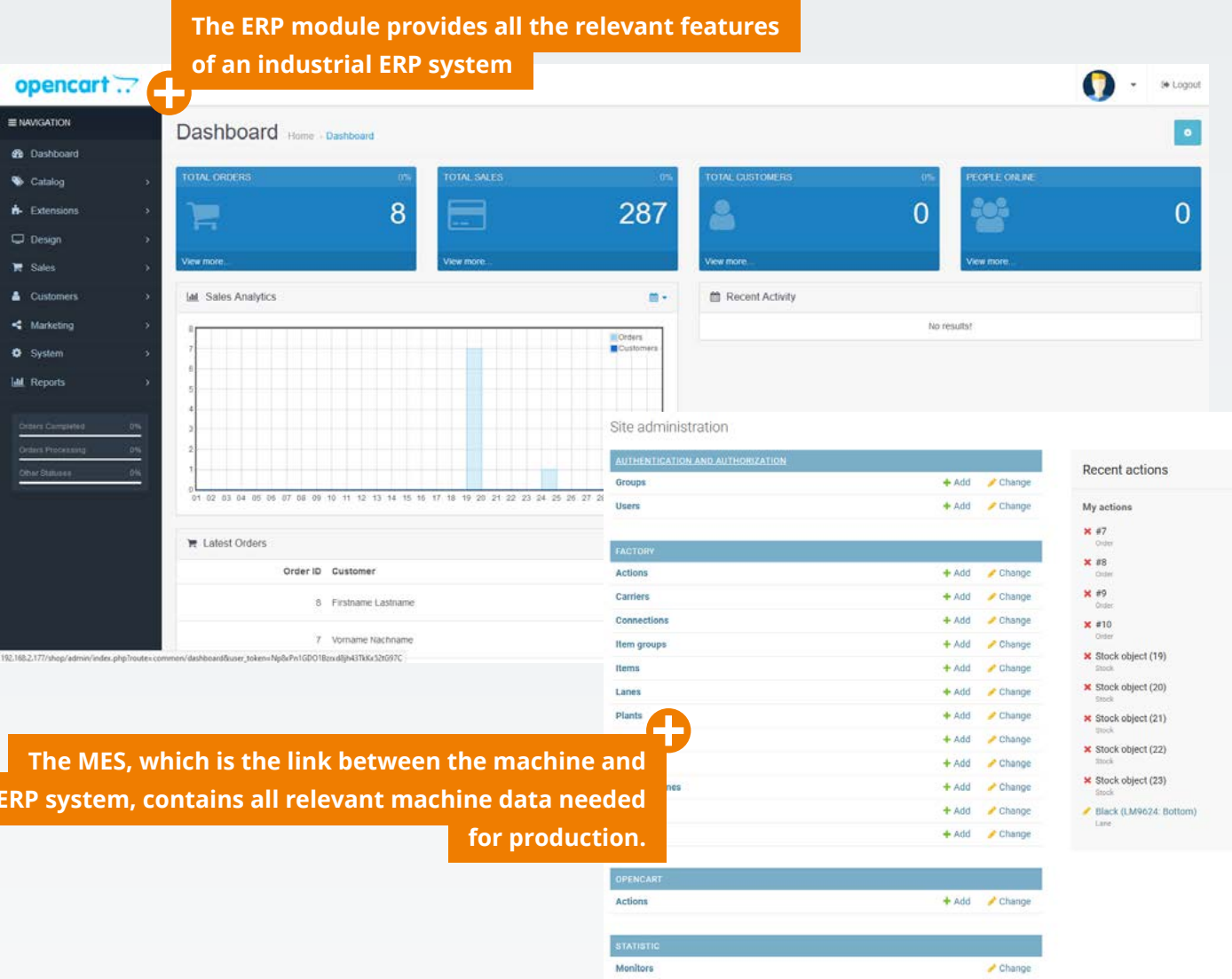


**+** Discover your 4.0 smart solution now!





# EVERYTHING UNDER CONTROL WITH THE ERP LAB



## The educationally adapted, equivalent alternative to industrial solutions

The ERP lab provides all the functionality needed to implement a smart factory solution. With the software components SCADA, MES, ERP and the webshop, every aspect is accounted for.

Whether it be 3D printing, production, or the smart manual

workstation, the heart of the system is the ERP lab. The ERP lab networks all the modules inside your laboratory. The option of linking up additional modules is always available.

Like all modules, the integrated webshop can be custom edited and permits orders to be placed via the Internet. The order information ends up in ERP system for processing and is then sent to the MES system as a production order. The production is then fully automatically commenced.

## Education and training in the foreground

This complex interplay between all the modules is imparted clearly and understandably in the corresponding Labsoft courses. That way the student can follow all the configurations, apply them independently, and also make any necessary adjustments.



# FROM THE IMS® SUBSYSTEM TO THE 4TH INDUSTRIAL REVOLUTION



CoAP



MES



## Flexible design and set-up

Thanks to the system's modularity, conveyor belt systems with processing stations can be assembled with great flexibility. In just a few minutes, the entire production line can be set up and flexibly adapted to meet instructional needs and then disassembled again.

## To fit any budget

Purchase can be made in stages. Start with a minimum equipment set and expand your system until it becomes a complex production line. On our homepage, you can find several examples of completely assembled production lines.



# SUBSYSTEMS AT A GLANCE



## Practical hands-on training guaranteed

**Modularity**  
Multiple combinations and varied projects are possible thanks to the system's modularity. Adapt the design and complexity to your needs.

**Adaptation just a matter of minutes**  
Because the components are designed modularly, the system can be modified to meet any instructional requirement in a matter of minutes. This happens without screws or having to lift and move complicated tables. The solid construction of the stations allows for easy assembly and disassembly.

**Based on real Industrial-like conditions**  
Almost all components are industrial type. This facilitates student orientation when working on a real job.



IMS® 1.2 Transport station



IMS® 1.5 Cyber-physical conveyor belt system



IMS® 3 Sorting station



IMS® 4 Assembly station



IMS® 5 Processing station



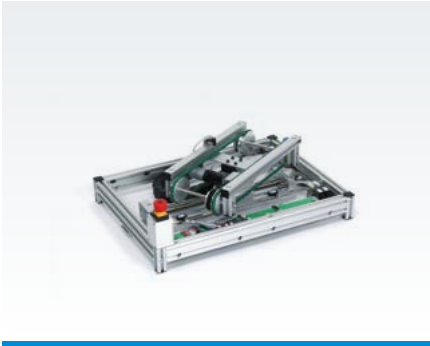
IMS® 6 Testing station



IMS® 7 Handling station



IMS® 8 High-rack warehouse station



IMS® 9 Routing station



IMS® 10 Buffer storage station



IMS® 11 Disassembly station



IMS® 13 Drilling and lathing station



# IMS® TRANSPORT AND SUBSYSTEMS



## IMS® Transport system

The transport or conveyor system is the anchor of all subsystems and thus the pivotal component of the entire manufacturing system.

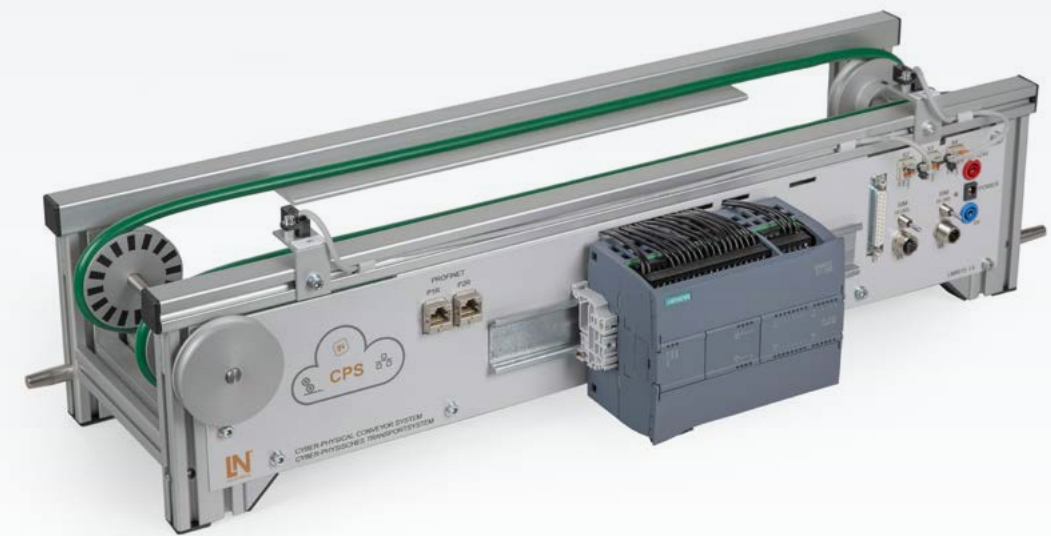
## IMS® subsystem

Each work step made during the entire manufacturing process is mirrored in its own so-called subsystem within the "Industrial Mechatronic System" IMS®. The subsystems are simply placed on the conveyor belt.

## Benefits

- Exercise on only one certain subsystem (station) or
- on a series of individually configured subsystems (stations)

# IMS® - CYBER-PHYSICAL TRANSPORT SYSTEM



## Situation

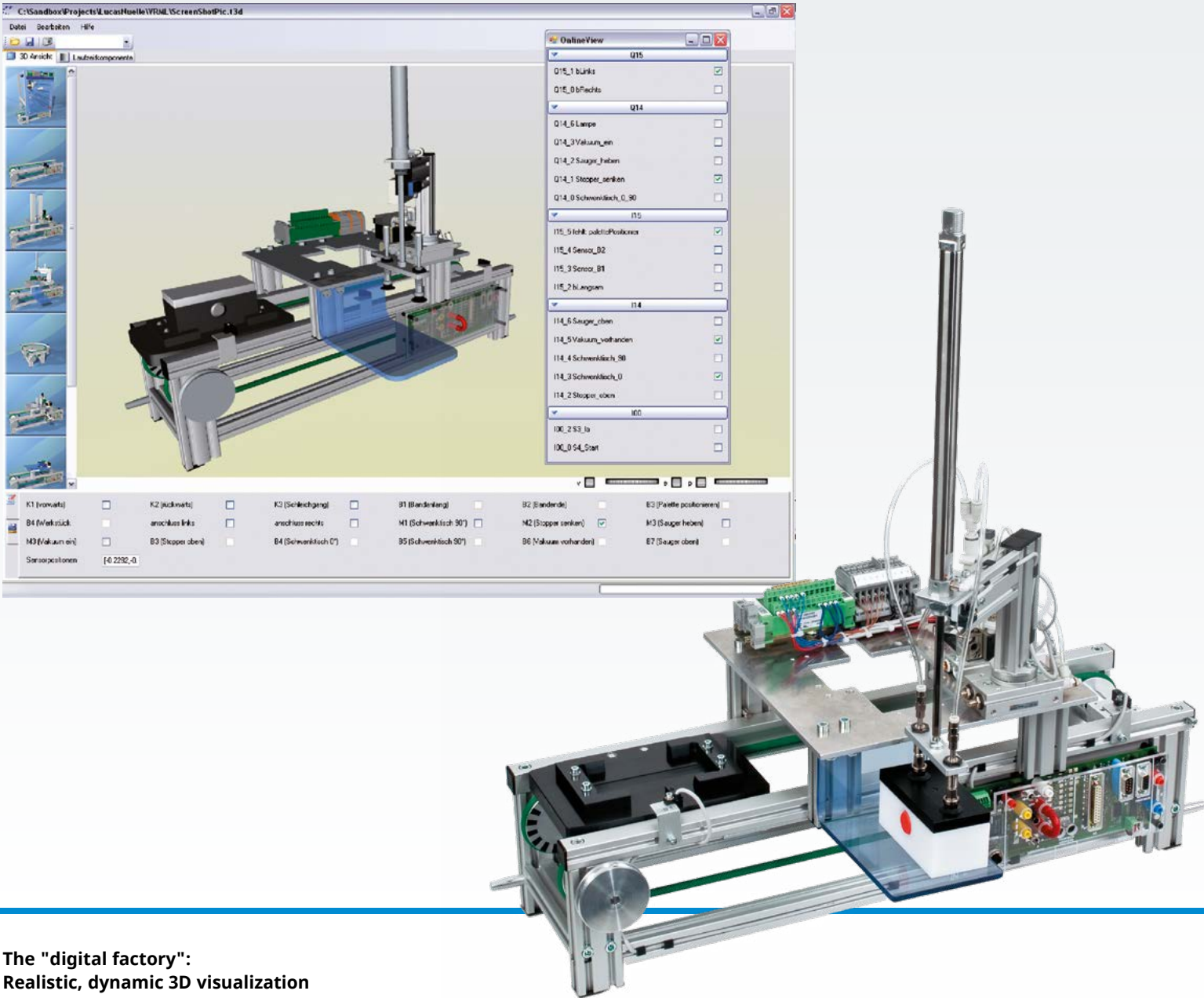
A front-mounted Siemens PLC can be custom programmed and takes over responsibility for control of the module. The processing stations attached to the conveyor belt can be controlled via the PLC using the 25-pin D-Sub connection terminal. The conveyor belt including the control unit forms a single compact unit. The system can be detached from the overall system and studied as a single workstation without having to make major reconfiguration or cable modifications. That way you avoid a rebuild or complicated reconfiguring of the tables.

## Training contents

- Belt control with variable speed using the PWM signal of the PLC
- Incremental encoded disk for position detection and speed measurement via optical sensor
- Measurement of power consumption for energy management
- Top-hat rail to expand PLC with analog or digital IO modules
- Add a PROFIBUS master module or IO link master module to expand PLC



# IMS® VIRTUAL – THE DIGITAL TWIN



### The "digital factory":

#### Realistic, dynamic 3D visualization

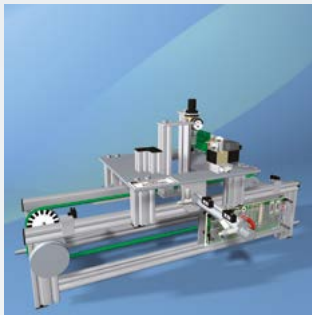
IMS® Virtual is a PC-based, graphically depicted 3D simulation system that provides the learning environment for the mechatronic training system IMS®. All of the components of the virtual subsystems and production lines are dynamically animated and depicted in real time in virtual 3D scenes. These 3D scenes are programmed like real physical models using STEP 7 and controlled using the "S7 PLCSIM" software.



IMS® 1 – Transport (conveyor belt) system



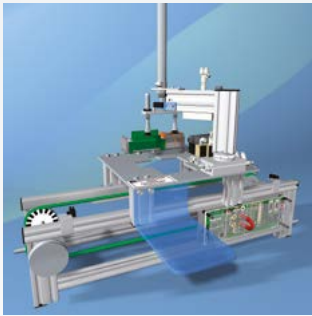
IMS® 3 – Sorting and  
IMS® 4 – Assembly



IMS® 5 – Processing



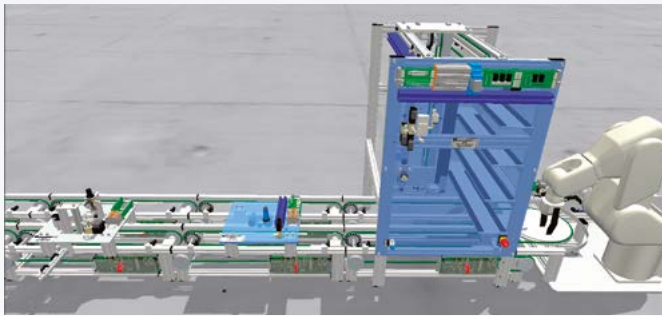
IMS® 5 – Testing



IMS® 7 – Handling



IMS® 8 – Storage



Production line IMS® 26 with industrial robot

### Training contents

- Simulation and visualization of technical manufacturing processes
- PLC programming according to IEC 1131-1 (ST, FBL and LAD)
- Open-loop control and testing of technical processes
- Configuring the parameters, programming and putting into operation technically different production line systems
- Carrying out systematic trouble-shooting on production lines
- Centralized operation and monitoring of production lines and processes
- Becoming familiar with the operation and system architecture of a production line system
- Exploring how an industrial robot operates in a production line system



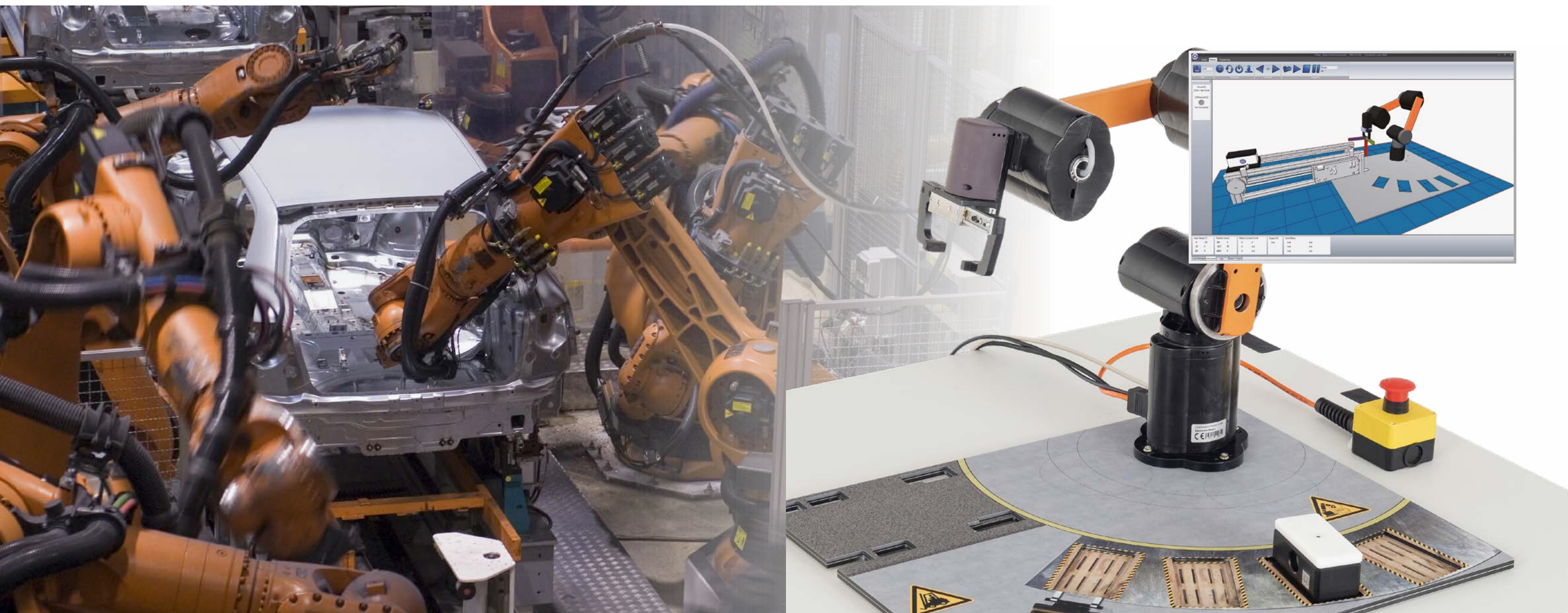
# ROBOT TECHNOLOGY

A large orange industrial robot arm is shown in a factory setting, holding a white car body part. The background features a complex network of metal beams, pipes, and other industrial equipment. The scene is brightly lit, typical of a modern manufacturing plant.

In modern highly automated and efficient manufacturing processes, robots play a huge role. The training package "Fundamentals of robot technology" takes the future automation technician or mechatronics specialist on a step-by-step journey through the basic principles including how to handle and program robots and demonstrates the optimum interplay between the robot and automation systems.



# TRAINING SYSTEMS FOR ROBOTICS



## Launch your journey into the world of robots

In modern, highly automated and efficient manufacturing processes, robots are taking on a huge role. The training package "Fundamentals of robot technology" takes the future automation technician or mechatronics specialist on a step-by-step journey through the basic principles, including how to handle and program robots and demonstrates the optimum interplay between the robot and automation system.

## Benefits

- Multimedia course with theoretical material, animations, experiment instructions and evaluations
- Full theoretical coverage to acquire an understanding of multi-axis robots including relevant safety precautions
- Inherently safe device (safety precautions not required)
- Contains lots of engaging experiments on 4-axis robots, conveyor belt and on PLC systems
- Programmability of the robot using the 3-D simulation software provided
- Know-how acquired is easily applicable to industrial robots

## The training system

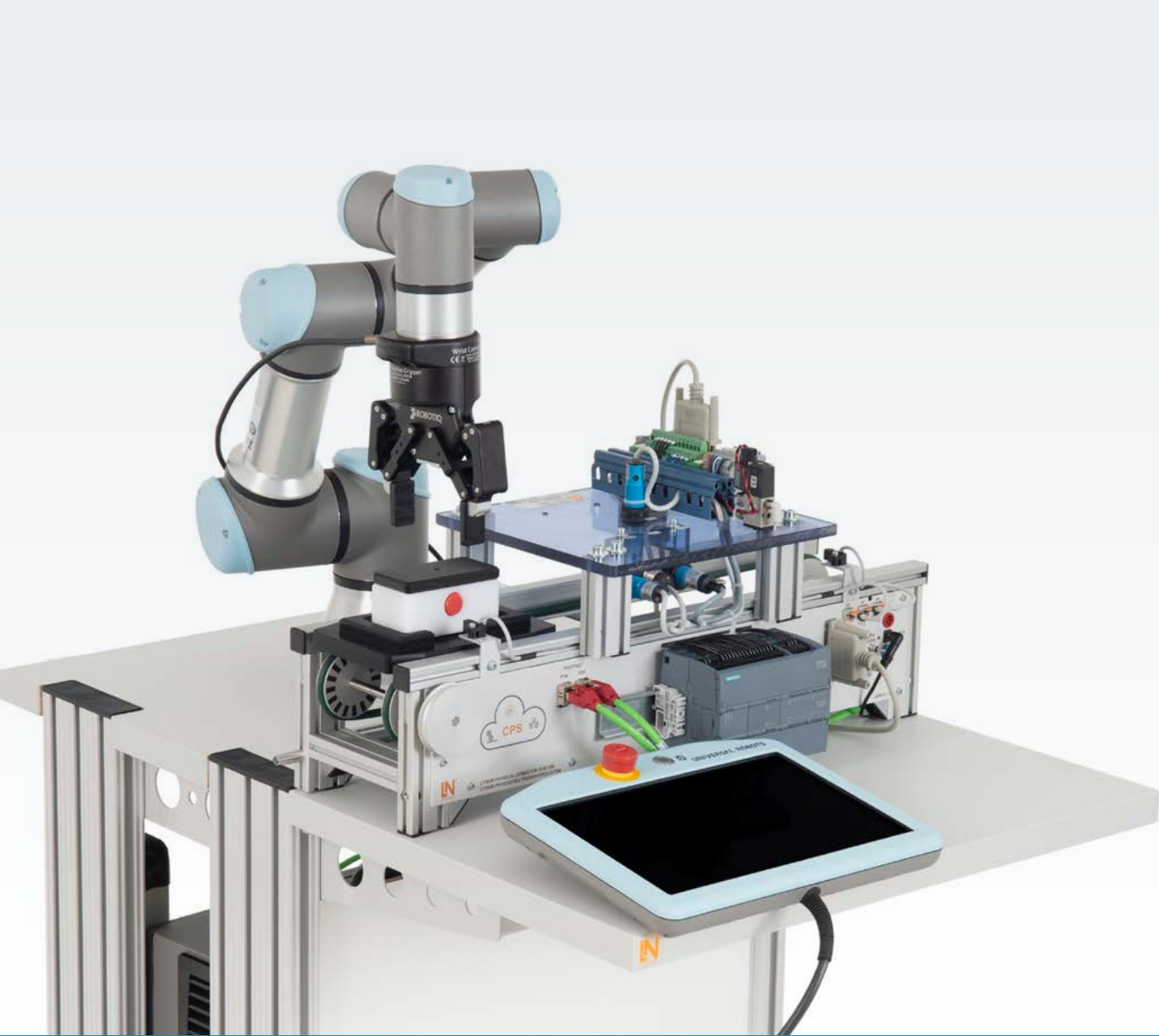
The Mover4HD is a four-axis robot arm designed for use in schools and colleges. With the Mover4HD automation, scenarios can be realistically modelled. It serves as the motion platform and connects tangible reality with physics, mathematics, and IT technology. The robot arm possesses four serial axes and can thus move in space and tilt its gripper angularly.

## Training contents

- Manually traversing the robot
- Programming movements
- Coordinate systems of the robot
- Speed and acceleration
- Singularities and symmetries
- Digital inputs and outputs
- Typical programming sample
- Program structures
- Final experiment



# COLLABORATING ROBOTICS



### Collaborative robots

Easy to program and quickly set up, the robot also has collaborating functionality and is safe. Thanks to its intuitive software, even inexperienced operators quickly learn the basics of programming. Desired traversing points are simply entered by moving the robot arm manually into the desired position.

### Benefits

- Electrically operated gripper: gripping force adjustable from 3 N to 40 N
- Adjustable gripper stroke of up to 110 mm
- Camera system for object recognition, taught-in objects are reliably grasped regardless of their location
- Robot arm can be manually traversed as desired
- PROFINET connection to PLC possible
- Security: Security function approved by TÜV NORD authorities
- Test in compliance with: EN ISO 13849-1, Cat 3, PLd and EN ISO 10218-1

Art. no. CCR 2 + Test project equipment set

# MOBILE ROBOTICS



### AGV - Automated guided vehicle with collaborative 6-axis robot arm

The system consists of a collaborative mobile robot with an additional collaborative 6-axis robot arm. This new generation of autonomous mobile robots is currently revolutionizing the way materials are being transported in company facilities. The operation of the automated guided vehicle (AGV) is achieved without magnetic loops in the floor by virtue of its camera system.

### Benefits

- Remote monitoring and control
- Interface to Lucas-Nuelle production planning system for the transmission of work orders.
- Route planning based on destination coordinates / stations
- Traversing on the planned route to the destination
- Recognition of obstacles in the path, deceleration/stop
- Determining evasive routes and following them
- Creation of a map based on scanner data and location finding and movement within the map
- Manual creation of periphery maps with walls, workstations and permitted routes
- EMERGENCY STOP

Art. no. CAV 1



# IMS® ROBOT TECHNOLOGY



### CRK 10 - Industrial standard robot programming

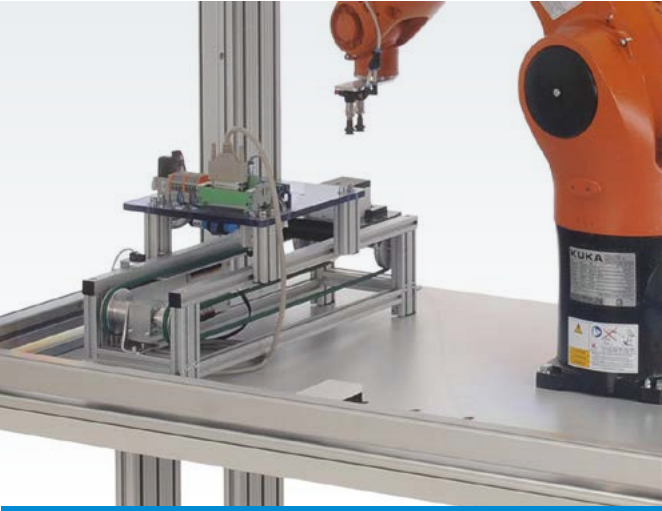
The Kuka KR6 R700 sixx is a 6-axis industrial robot which makes it possible to work, control and program on a professional level. A simple introduction to programming is ensured thanks to the clearly structured Teach Pendant. Project data can be transferred between the robot and the PC using a direct PC connection via Ethernet.

### Benefits

- Compact, fast and agile robot from the industrial arena with 6 degrees of freedom
- Pro training system: permits learning under realistic work conditions
- International automotive standard: corresponding to conventional industrial design
- Programming using Teach Pendant
- Project planning possible using the software provided
- Connection to the PLC via the PROFINET

Art.-no. CRK 10

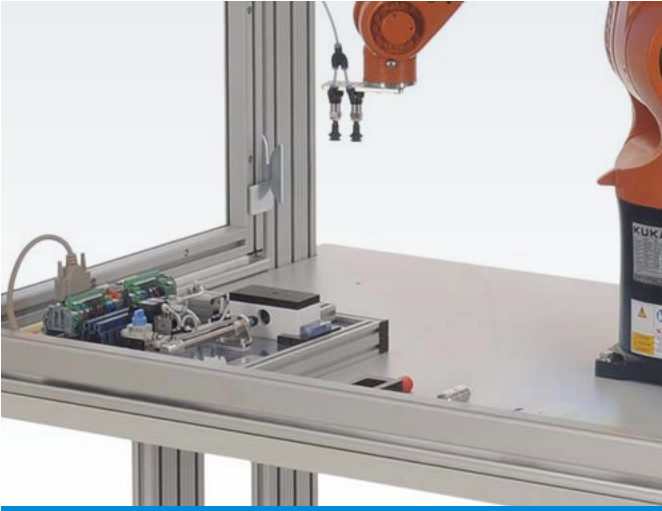
# PROJECT WORK WITH THE ROBOT



### Test project equipment set

After manufacturing a workpiece, the robot retrieves the manufactured part and transfers it to the "Test" station. The correct assembly of the workpiece is inspected at the test station using a variety of sensors. After testing, the finished piece is transported back to the production line.

Art. no. CRK 11



### Disassembly project equipment set

After completing the manufacturing of the workpiece, it is determined if this has been installed properly. The robot removes the part from the production line and leads it to the disassembly station. At this station, the robot helps to disassemble the workpiece into its component parts. The robot sorts the individual components into storage trays.

Art. no. CRK 12



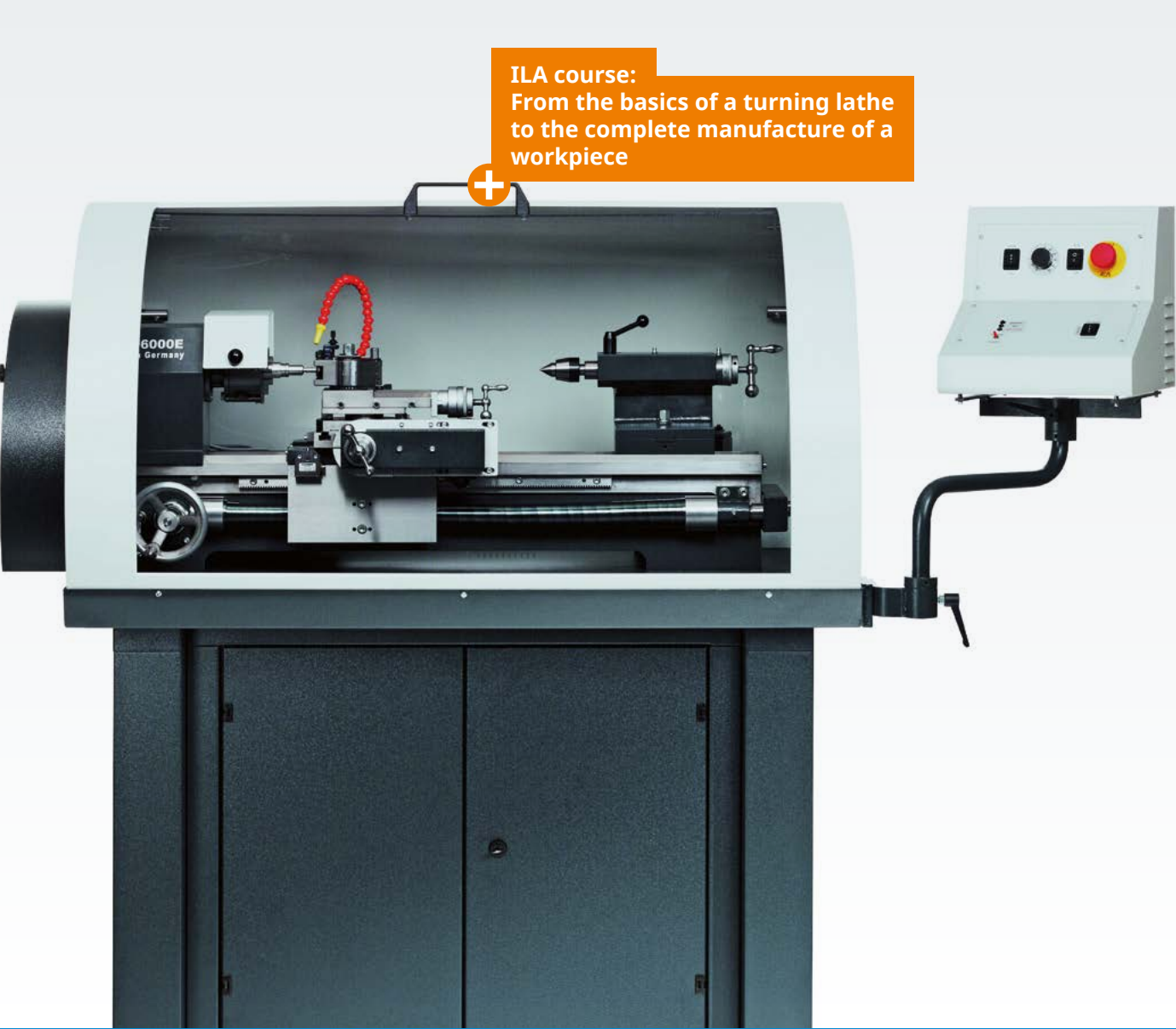


# COMPUTER INTEGRATED MANUFACTURING CIM

Integration into automation technology  
CNC programming and machining is an important task of many metalworking companies and places high demands on the student and trainee. Lucas-Nuelle offers solutions for CNC training that fits the IMS® program. The CIM training system is a system that fulfils all the requirements of a modern vocational and advanced training system in the area of metalworking. In project planning work, the workpieces can be machined for the IMS area.



# CIM 1 - LATHE



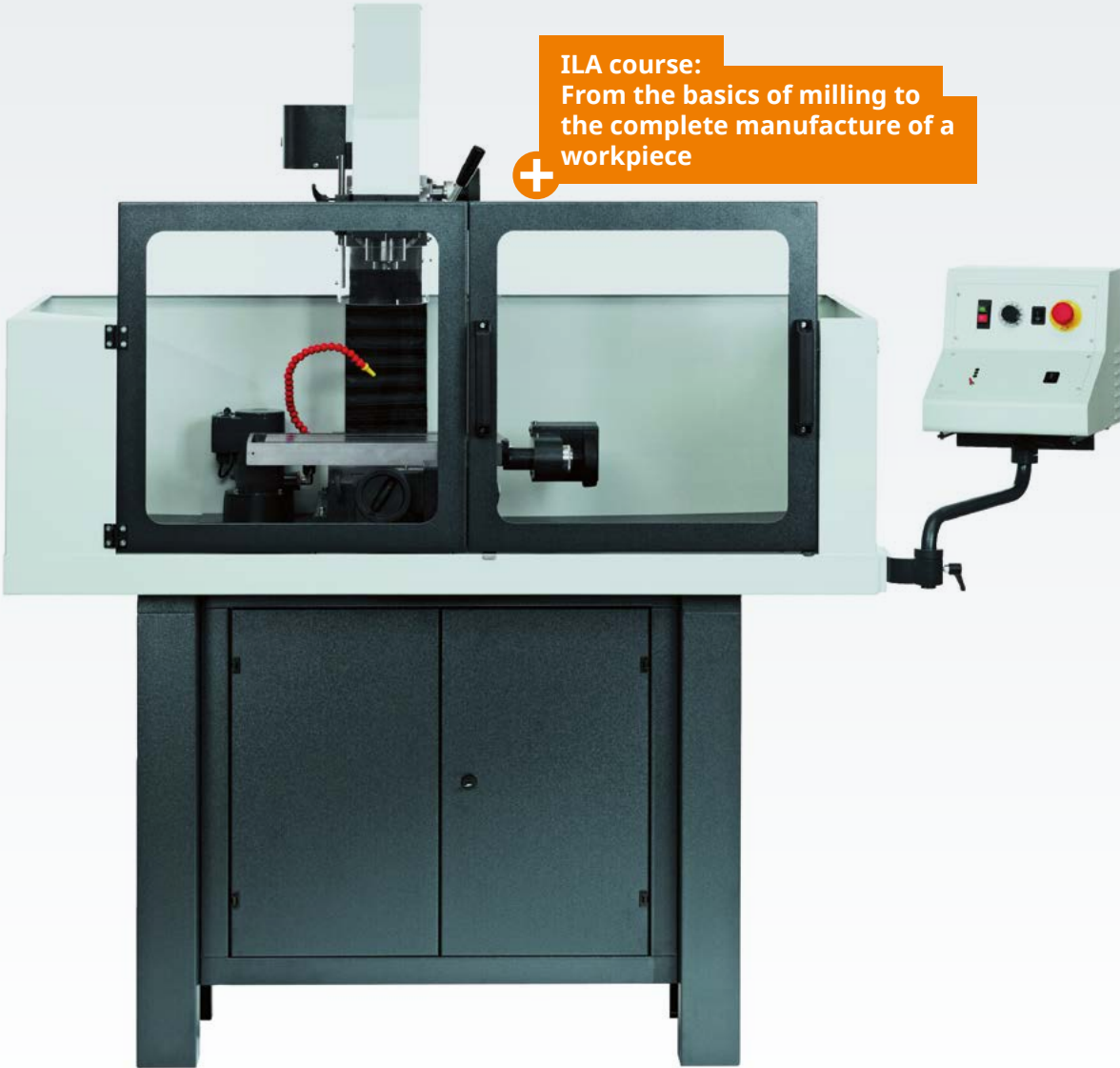
ILA course:  
From the basics of a turning lathe  
to the complete manufacture of a  
workpiece

The compact lathe machine is an optimum solution for vocational training and conforms to industry standards in terms of design and operation. With the machine, you can realistically demonstrate and explain all the essential processes found in modern manufacturing. Sensible simplification, a clearly structured machine design combined with easy-to-operate features are the key to rapid learning success.

- Benefits**
- Compact CNC lathe machine
  - Industrial, prismatic cast iron bed
  - Direct control using the programming software provided or with conventional manual operation
  - Safety machine cabinet
  - Clockwise and anticlockwise spindle operation
  - Continuously adjustable main drive
  - Automatic 8-fold tool changer
  - The complete manufacturing process can be automated by connecting up a robot
  - Connection to IMS® also possible
  - Manufacture of bolts for IMS®
  - ILA course
    - ' Material composition
    - ' Geometric and technological principles
    - ' Project-based workpiece manufacturing

Art. no. CIM1

# CIM 2 – MILLING MACHINE



ILA course:  
From the basics of milling to  
the complete manufacture of a  
workpiece

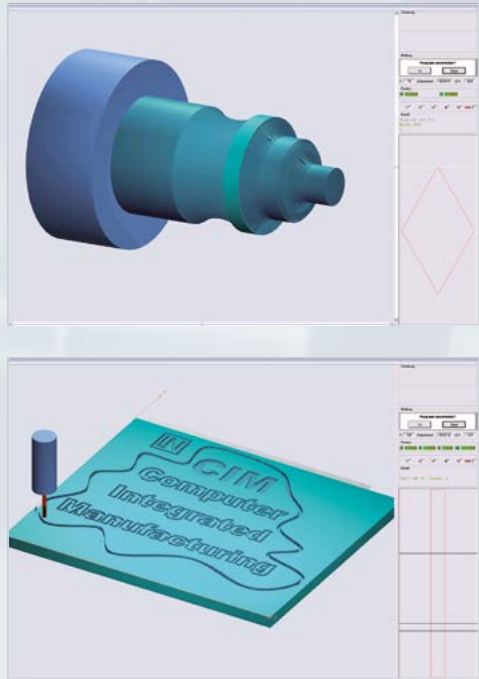
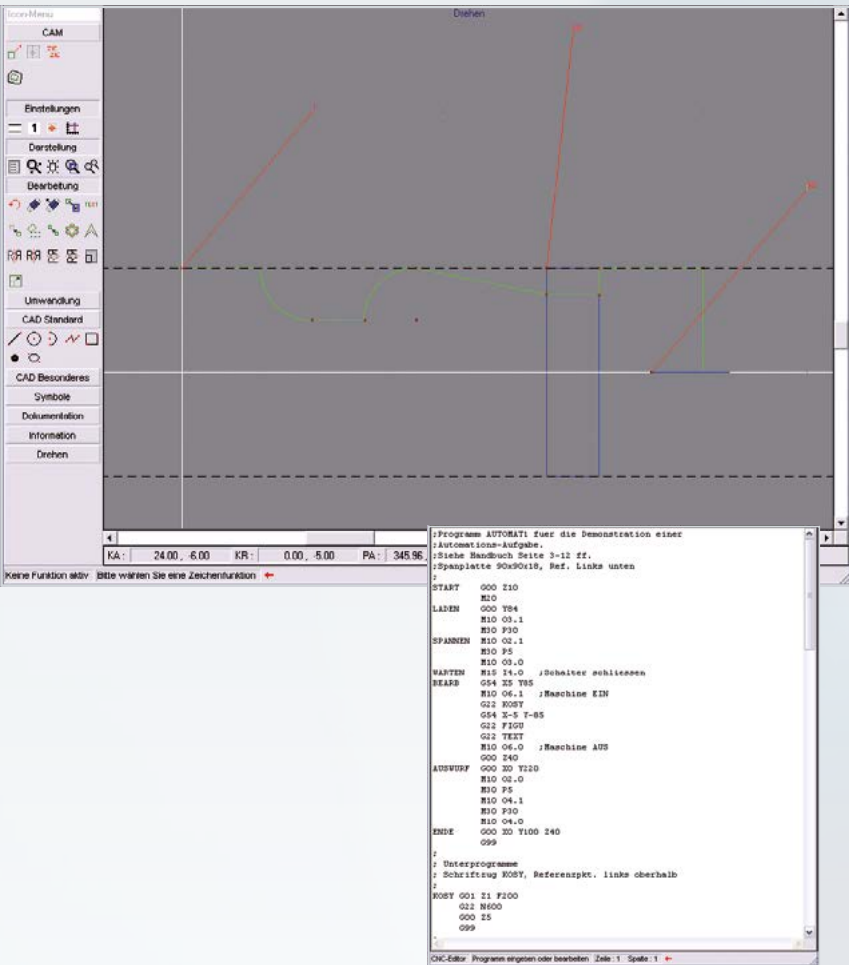
The compact milling machine is an optimum solution for vocational training and conforms to industry standards in terms of design and operation. With the machine, you can realistically demonstrate and explain all the essential processes found in modern manufacturing. Sensible simplification, a clearly structured machine design combined with easy-to-operate features are the key to rapid learning success.

- Benefits**
- Compact 3-axis CNC milling machine
  - Solid, industrial cast-iron construction
  - Direct control using the programming software provided or with conventional manual operation
  - Safety machine cabinet
  - Clockwise and anticlockwise spindle operation
  - Continuously adjustable main drive
  - The complete manufacturing process can be automated by connecting up a robot
  - Connection to IMS® also possible
  - Permits manufacture of upper and lower sections for IMS®
  - ILA course
    - ' Material composition
    - ' Geometric and technological principles
    - ' Project-based workpiece manufacturing

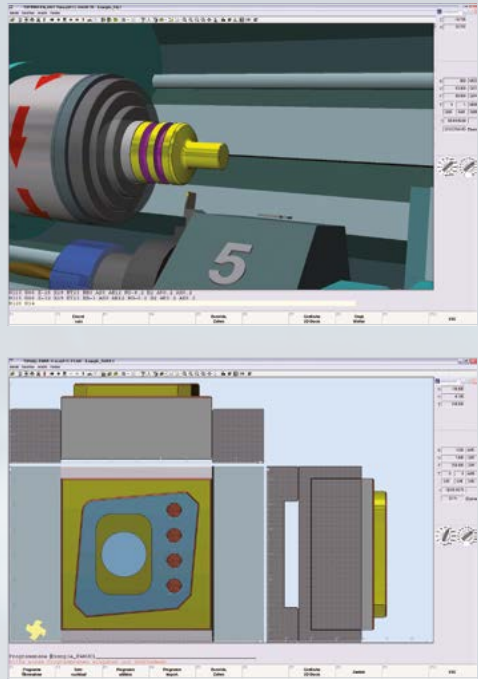
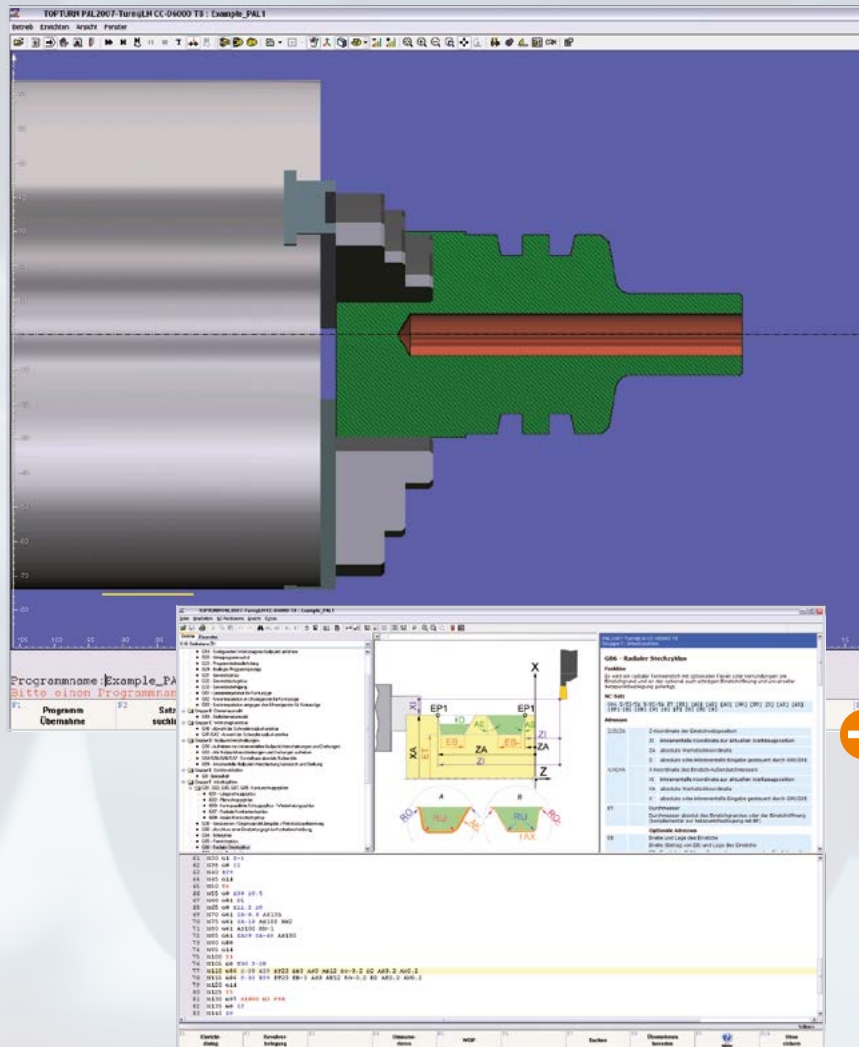
Art. no. CIM2



# PROGRAMMING SOFTWARE



# PROFESSIONAL 3D PROGRAMMING SOFTWARE



**+ Programming in PAL or Fanuc**

The software provided for the machines permits the student to quickly and easily go from the construction of a product to a finished workpiece. Also, an easy-to-use operating feature facilitates taking complex contours and converting them from any given drawing in DXF or HPGL formats and transferring them to the CNC machine for processing.

## Scope of functionality

- Programming input according to DIN 66025 with G and M functions as well as graphic programming
- 3D or 2D simulation of the processing procedure with the tool depicted
- Automatic CNC program creation
- Manual operating field
- Data acquisition from DXF or CAD files and conversion into an operational program
- Inputting technology values
- Machine-independent program creation

CNC machines can be programmed directly using professional 3D programming software. The programs which can be simulated in 3D are created, tested, and converted into a special G-code adapted by a post-processor specifically for the CIM1/2 machines. The professional 3D software can be obtained in the lathe and milling machine versions. There is also an automated manufacturing option available. This is achieved by using a tool changer, thread cutter in CNC operation, an electronic manual wheel, and also by utilizing higher processing speeds.

## Training contents

- Program input according to DIN 66025 with G and M functions as well as PAL programming
- 3D or 2D simulation of the processing procedure with depicted machine and tool
- Data transfer from PAL or Fanuc source code and conversion into an operational G-code program
- Inputting technology values
- Machine-independent program creation
- Cutting radius compensation





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