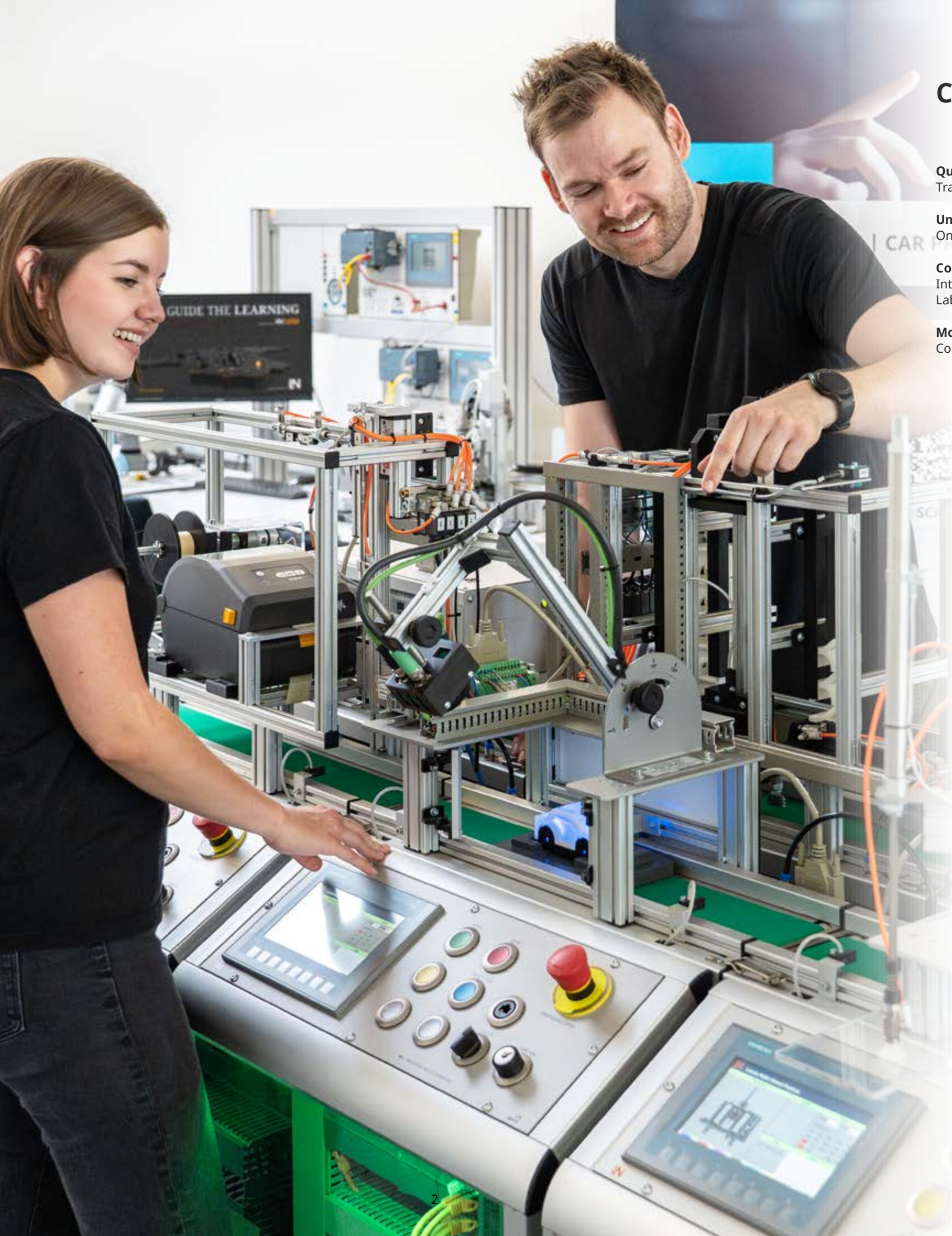


# TRAINING SYSTEMS FOR AUTOMATION TECHNOLOGY

Acquire practical and project-oriented  
action competencies



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## QUALIFIED FOR INDUSTRY



### Training systems for automation technology

#### Technological progress...

In Industry 4.0, production is intertwined with state-of-the-art information and communication technology. This enables tailor-made products according to individual customer requests – cost-effectively and in high quality. The foundation lies in acquiring process statuses and controlling process variables. This is achieved through a wide variety of sensors that operate according to different physical principles. Knowledge of sensor technology is therefore indispensable for anyone who comes into contact with automation or control engineering, including the mechatronics engineer.

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

Changed requirements necessitate new, modern, practice-oriented teaching systems. These convey the current state of the art and the necessary action competencies to the learner.

#### Strong partnership with industry

is the guarantee for practical relevance. With the market leader Siemens AG, Lucas-Nülle has found this strong partner. State-of-the-art automation technology products from Siemens are didactically prepared by Lucas-Nülle and precisely adapted to the needs of schools and educational institutions. From the compact basic version up to the modular high-end system with fieldbus interface and decentralized periphery as well as associated operation and monitoring devices, all performance levels are completely covered.

Naturally, safety technology according to the new European Machinery Directive can be integrated into all systems.

The modular and scalable teaching and training systems form the innovative and future-proof foundation for a solid and thorough education in the field of automation technology.

# UNITRAIN – MOTIVATED LEARNING WITH A CONCEPT

## One system for all technical training

Acquiring knowledge and action competencies about technical systems of steadily increasing complexity in ever shorter times is the great challenge in technical education today and tomorrow. The UniTrain system, the computer-assisted, multimedia experimental and training system for electrical engineering and electronics education, helps to meet this challenge.

The combination of learning programs with a complete electronics laboratory in just one mobile interface enables the efficient impartation of theory and practice at any place and at any time.

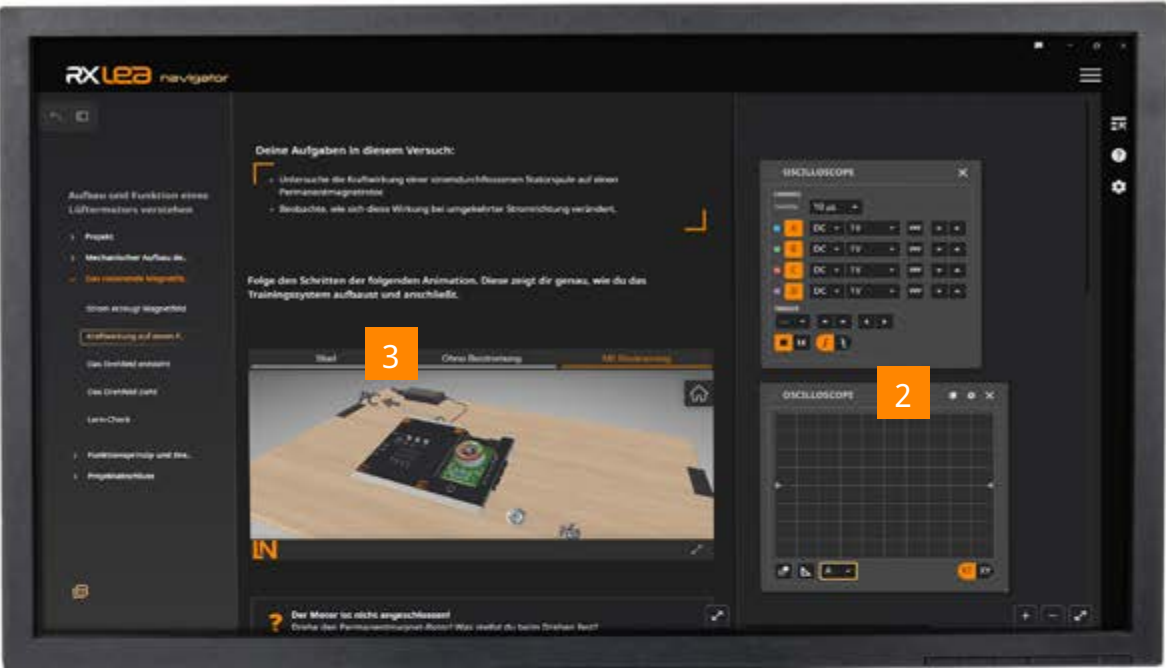


**3 RXLea-Projects**  
Hundreds of learning projects with experimental hardware from all areas of electrical engineering.

**NEW: Integrated WLAN Module**



**2 Virtual Instrument**  
120 virtual instruments for controlling the interface.



### YOUR ADVANTAGES

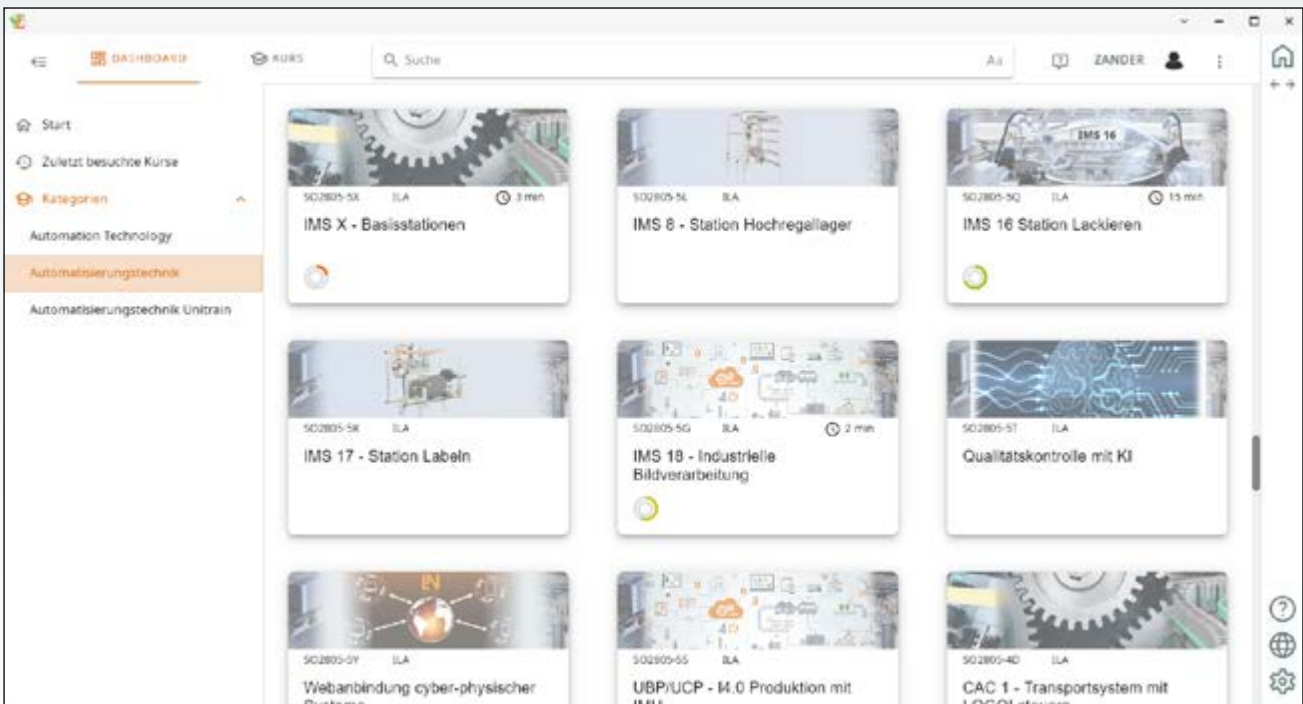
- Universal training system
- Mobile and usable anywhere
- Promotes individual learning
- Action competency through practical experiments
- High motivation through changing requirements
- Safe experimenting through protective extra-low voltage
- Learning programs combine theory and practice
- For the entire field of electrical engineering

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



**4 Experimenter**  
Holder for the experiment cards and additional  
voltage outputs (three-phase current).

# COMPUTER-ASSISTED LEARNING ENVIRONMENT



## Interactive Lab Assistant (ILA)

When conducting 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 measured values, and thus automatically creates the necessary laboratory documentation in the background as a printout or PDF document. If you want to customize the instructions, simply use the LabSoft Classroom Manager to change or add content.

## Advantages

- Theory conveyed through easily understandable animations
- Support during experiment execution
- Interactive representation of the experimental setups
- Access to real measurement and testing devices with comprehensive evaluation options
- Practice-oriented project tasks
- Integrated operating instructions
- Documentation of the experiment results (creation of an experiment report)
- Knowledge assessment incl. feedback function

## The LabSoft Classroom Manager

is comprehensive administration software with which practice-oriented teaching and learning processes can be comfortably organized and managed. The Classroom Manager is suitable for all LabSoft-based learning programs such as ILA, UniTrain, InsTrain, and CarTrain.

It consists of the following program components:



### LabSoft Manager

Manage your LabSoft courses, learners, and learning groups with the LabSoft Manager. This ensures the appropriate learning content is always available to the learners.



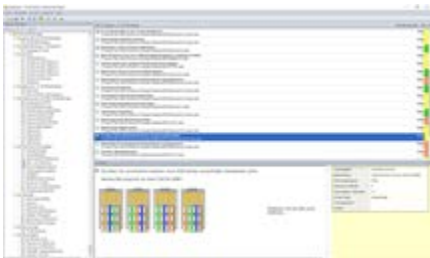
### LabSoft Questioner

Many question types are available in the LabSoft Questioner for creating questions, measuring tasks, and exam questions. The tasks and questions can be inserted into courses and exams.



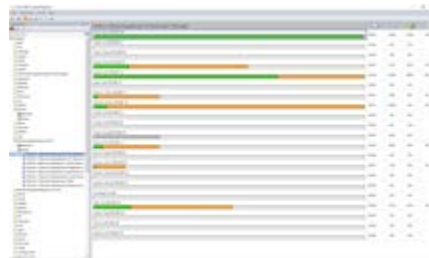
### LabSoft Editor

Numerous assistants in the LabSoft Editor help in creating new courses and guide the user step-by-step through the necessary entries.



### LabSoft TestCreator

Creates exams that can simultaneously test knowledge and action competency. Filter functions help with the manual or automatic selection of exam questions.



### LabSoft Reporter

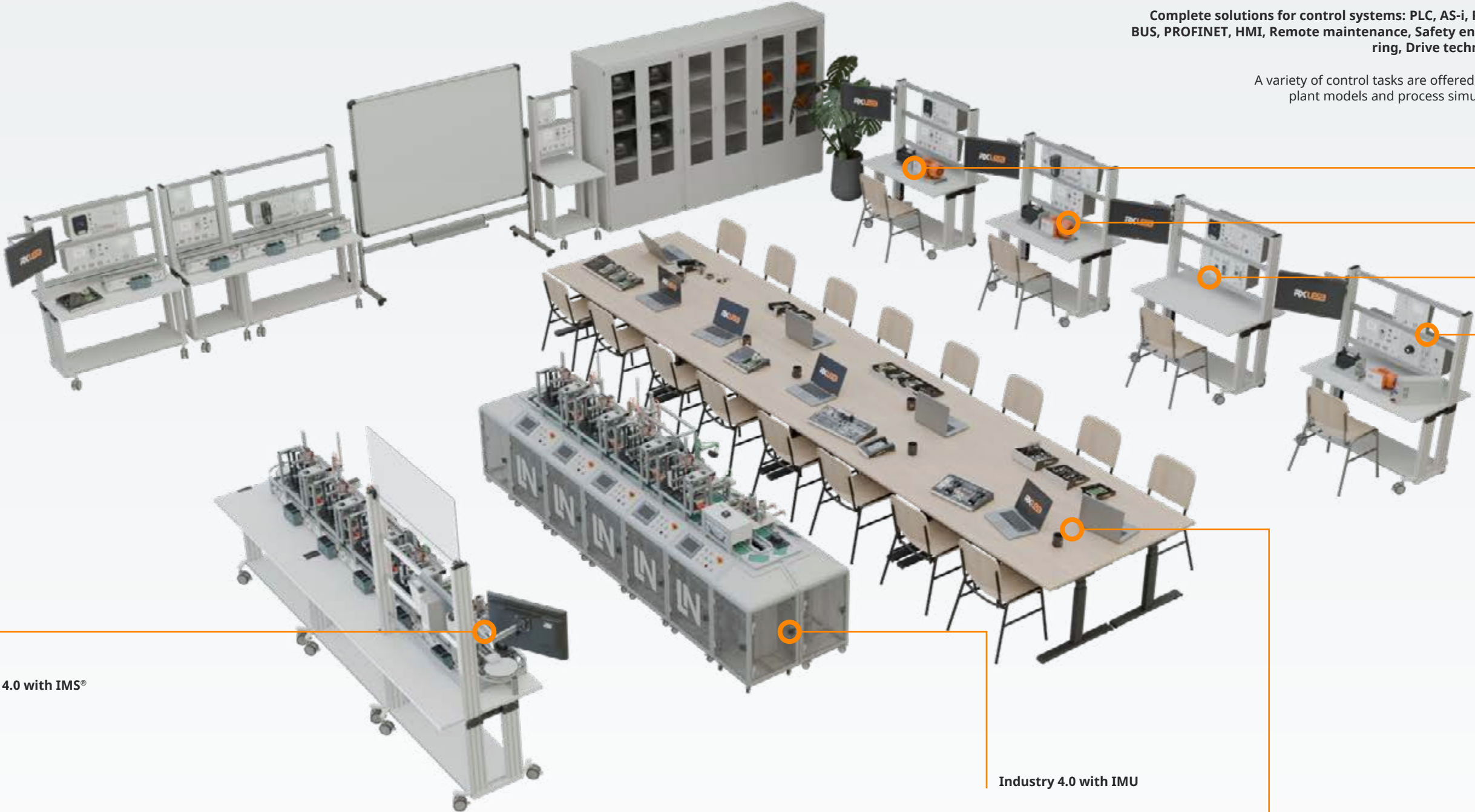
The LabSoft Reporter presents learning progress and exam results. Numerous evaluations for individual or group results of courses and exams enable targeted monitoring.



### LabSoft ControlCenter

With the ControlCenter, you are always up to date during your training sessions. It shows what your learning group is currently working on, displays help requests, and allows broadcasting individual screen contents to the group.

# MORE THAN A LABORATORY



Industry 4.0 with IMS®

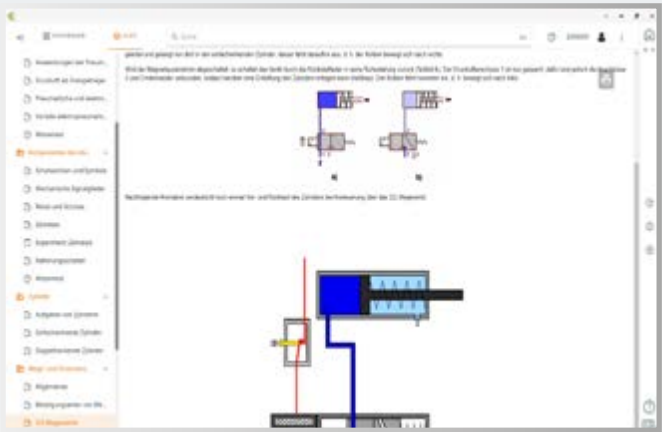
Industry 4.0 with IMU

**Blended Learning**  
Multimedia knowledge transfer with UniTrain.

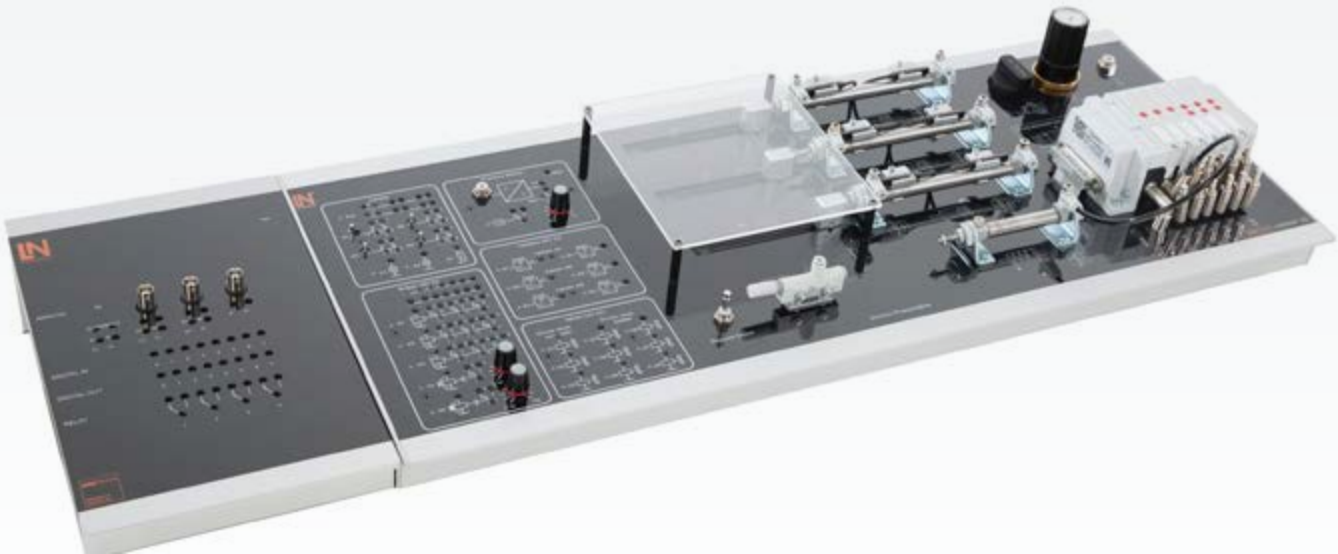
# FUNDAMENTALS OF AUTOMATION TECHNOLOGY

Automation technology is taking on an increasingly important role due to the advancing process automation in industry. There is close intertwining with other areas such as drive, control, or computer technology. Due to rapid developments, automation technology has become one of the most innovative and fast-paced fields in electrical engineering.

# PNEUMATICS / ELECTROPNEUMATICS



Pneumatik CO4204-5E



## Pneumatics for education

The course imparts fundamental knowledge of pneumatics. In all practice-oriented project tasks, core and technical qualifications are taught in an integrated manner, involving independent planning, execution, and checking. A broad-based basic education is intended to convey skills and qualifications in a practical manner. To exercise a qualified professional activity, students should particularly learn independent planning, execution, and checking as well as acting within the overall operational context.

## Learning contents

- Fundamentals of pneumatics
- Mode of operation of single- and double-acting cylinders
- Getting to know various directional control valves
- Mode of operation and design of electropneumatic controls
- Hard-wired programmed controls
- Programmable logic controls
- Recording of displacement/time diagrams
- Time-dependent controls

# HYDRAULICS / ELECTROHYDRAULICS



## Hydraulics for education

Thanks to the leak-free connection hoses, safe and clean work in the classroom is possible even at a pressure of up to 40 bar. The accompanying UniTrain self-learning course guides the learners through the complete fundamentals of hydraulics. You create logical operations in the circuit diagram editor integrated into the software or wire the required projects classically with the control elements integrated into the board.

## Learning contents

- Fundamentals of hydraulics/electrohydraulics
- Hydraulic and electrical circuit diagrams
- Single- and double-acting cylinders
- Extending a cylinder via a push button
- Extending a cylinder with self-holding
- Limit switches as normally closed contacts
- Feed control with start condition
- Start interlocking with arbitrary intermediate stop
- Pressure-dependent control
- Mechanical interlocking of a push-button contact
- Electrical interlocking of a push-button contact
- Rapid traverse feed circuit
- Time-dependent control
- Recording of displacement/time diagrams

# FUNDAMENTALS OF PLC TECHNOLOGY



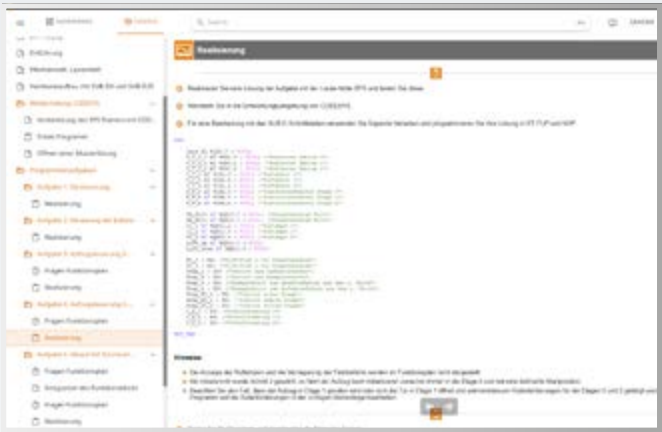
## Programmable Logic Controller (PLC)

Today's highly automated industrial landscape is characterized by almost autonomously operating machines. These systems are generally operated by programmable logic controllers. An understanding of how controllers work and how they are networked is indispensable. The manufacturer-neutral PLC fundamentals board not only provides a successful introduction to this topic.

## Learning contents

- Fundamentals and basic terms of the PLC
- Design and mode of operation
- Logic operations, memory functions, timer and counter functions, analog value processing
- Project planning of an automation system
- Programming with ST, FBD, or LAD according to IEC 1131
- Composite basic logic operations
- Project planning of digital technology
- Project planning of traffic light control
- Project planning of analog value processing
- Project planning of 7-segment displays

# PLC PLANT MODEL



## Practical relevance of the PLC

With this compact learning system, the logical sequences of an elevator can be learned and programmed. Through the realistic representation of the entire elevator system, the learner grasps the processes more quickly. The use of industrial components helps with later orientation in professional life.

## Learning contents

- Manual control of the motors
- Acquisition of sensor signals
- Elevator control for two floors
- Elevator control for three floors
- Elevator control with door control
- Learning and programming EMERGENCY STOP functionality

# PROGRAMMABLE LOGIC CONTROLLERS

## Integral component of automation technolog

New focal points in education require new qualifications in the disciplines of control technology, electromechanics, electronics, and computer-assisted controls (PLC).

With many examples, explanations, exercises, and practical tasks, the fundamentals and functions of the PLC are vividly illustrated.

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



### The training system for 1500 series controllers

Training system for PLC devices of the SIMATIC S7-1500 series. Optionally, an S7-1512C or an S7-1516 can be used. The freely accessible profile rail is equipped with the 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 plug sockets.

### Technical Data

- 16 digital inputs DC 24 V on 4 mm safety sockets
- 16 push buttons/latching switches to simulate 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 plugs
- 16 digital outputs DC 24 V via 9-pin, 25-pin, and 37-pin system plugs
- 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 adjustable -10 V ... +10 V via potentiometer
- 1 analog output adjustable 0 ... 20 mA via potentiometer
- 9-pin and 25-pin sockets for direct control of mechatronic systems
- 37-pin plug and 37-pin socket

Art. No. CLC15 SPS mit S7-1516

# S7-1512C SPS



### The training system of the 1512C controller

Training system for PLC devices of the SIMATIC S7-1500 compact series. In contrast to the S7-1516, the compact controller S7-1512C is only equipped with Profinet. Profibus is omitted here. Modern production facilities nowadays mostly use Profinet as the bus system.

### Technical Data

- 16 digital inputs DC 24 V on 4 mm safety sockets
- 16 push buttons/latching switches to simulate 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 plugs
- 16 digital outputs DC 24 V via 9-pin, 25-pin, and 37-pin system plugs
- 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 adjustable -10 V ... +10 V via potentiometer
- 1 analog output adjustable 0 ... 20 mA via potentiometer
- 9-pin and 25-pin sockets for direct control of mechatronic systems
- 37-pin plug and 37-pin socket

Art. No. CLC15 SPS mit S7-1512C

# TRAINING SYSTEM FOR PROGRAMMABLE LOGIC CONTROLLERS (PLC) S7-1215C



**The S7-1200 training system at a glance**

The basic device is equipped with a SIMATIC S7-1200, a KTP700 touch panel, and a power supply unit, thus forming an independent, compact, and expandable training system. The KTP700 touch panel has an Ethernet interface for communication and programming. The networking of all devices is easily done via the 5-port Ethernet switch.

**Benefits**

- SIMATIC S7-1200 with CPU 1215C DC/DC/DC
- Sturdy console housing with non-slip feet
- Integrated power supply: 24V/5A DC
- Sockets for EMERGENCY STOP loop (voltage disconnection of the output modules)
- Integrated touch panel
- 5-port Ethernet switch for networking the PLC with KTP700
- 9-pin and 25-pin sockets for direct evaluation of mechatronic systems
- Individually expandable with PROFIBUS or AS-i master modules



**Visualization for automation**

Via the KTP700 and MTP700 touch panels, entire applications or simply signals can be displayed. Control mechanisms such as buttons or switches complete the requirements for operation and monitoring.

**Benefits**

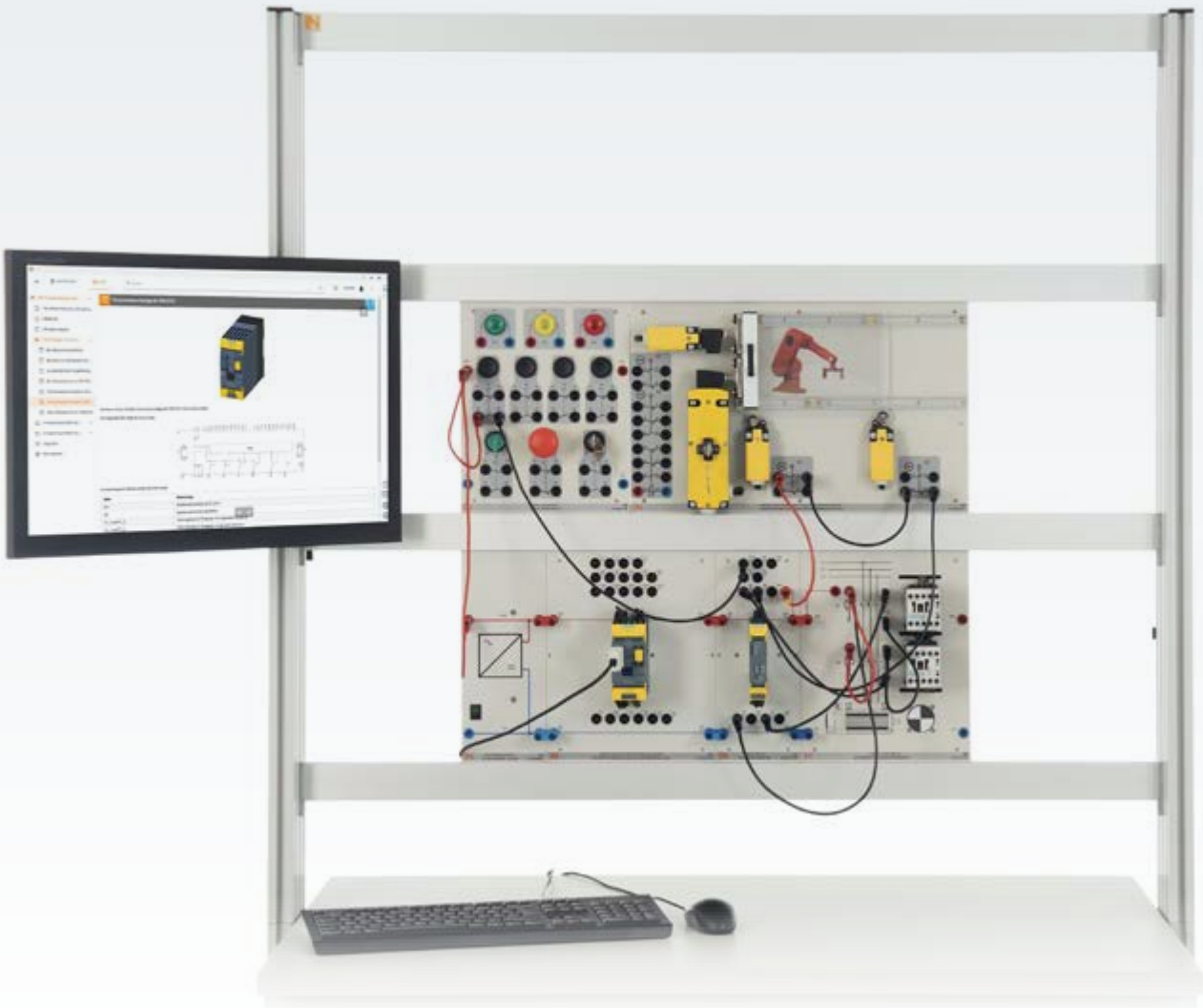
- Programming of the touch panels is done via the included TIA Portal software
- Full-graphic color display (16 million colors)
- Touchscreen 7"
- Resolution: 800 x 480 pixels
- Interfaces PROFINET I/O, USB
- Display of fault and operating messages
- Recipe management
- Wide viewing angle
- Dimmable LED backlight from 0 ... 100 %

# SAFETY ENGINEERING IN AUTOMATION TECHNOLOGY

A close-up photograph of a human hand hovering just above a control panel. The hand is positioned over two buttons: a prominent red emergency stop button with a yellow base, and a smaller, silver-colored push-button. The background is blurred, showing what appears to be a workshop or industrial setting with various equipment and components.

The training systems on the subject of „Safety Engineering“ cover the entire spectrum. Optical systems, such as light curtains or laser scanners, can easily be integrated into these systems. The central model is the safety door with a safety position switch, on which a wide variety of safety applications can be learned. The safety engineering systems are an excellent addition to the "Industrial Mechatronic System" IMS®.

# CIRCUITS WITH SAFETY RELAYS



## Fundamentals: Safe with contactors

The central model is the safety door with a safety position switch. Various safety applications with the corresponding safety circuits can be learned here:

- Safety position switch with roller lever
- Safety position switch with guard locking
- Safety position switch with separate actuator
- Emergency stop circuit

## Benefits

- Safety categories according to EN 954-1
- Redundant structure of safety circuits
- Signaling of the system states
- Parameterize and commission safety relays
- EMERGENCY STOP
- Direct shutdown with guard locking of the safety door

# CYBER SECURITY



## Cyber Security in Automation Technology

In modern production plants, the topic of cyber security is indispensable. Many exercises are used to impart all common protective measures against cyber attacks on automation systems.

## Learning contents

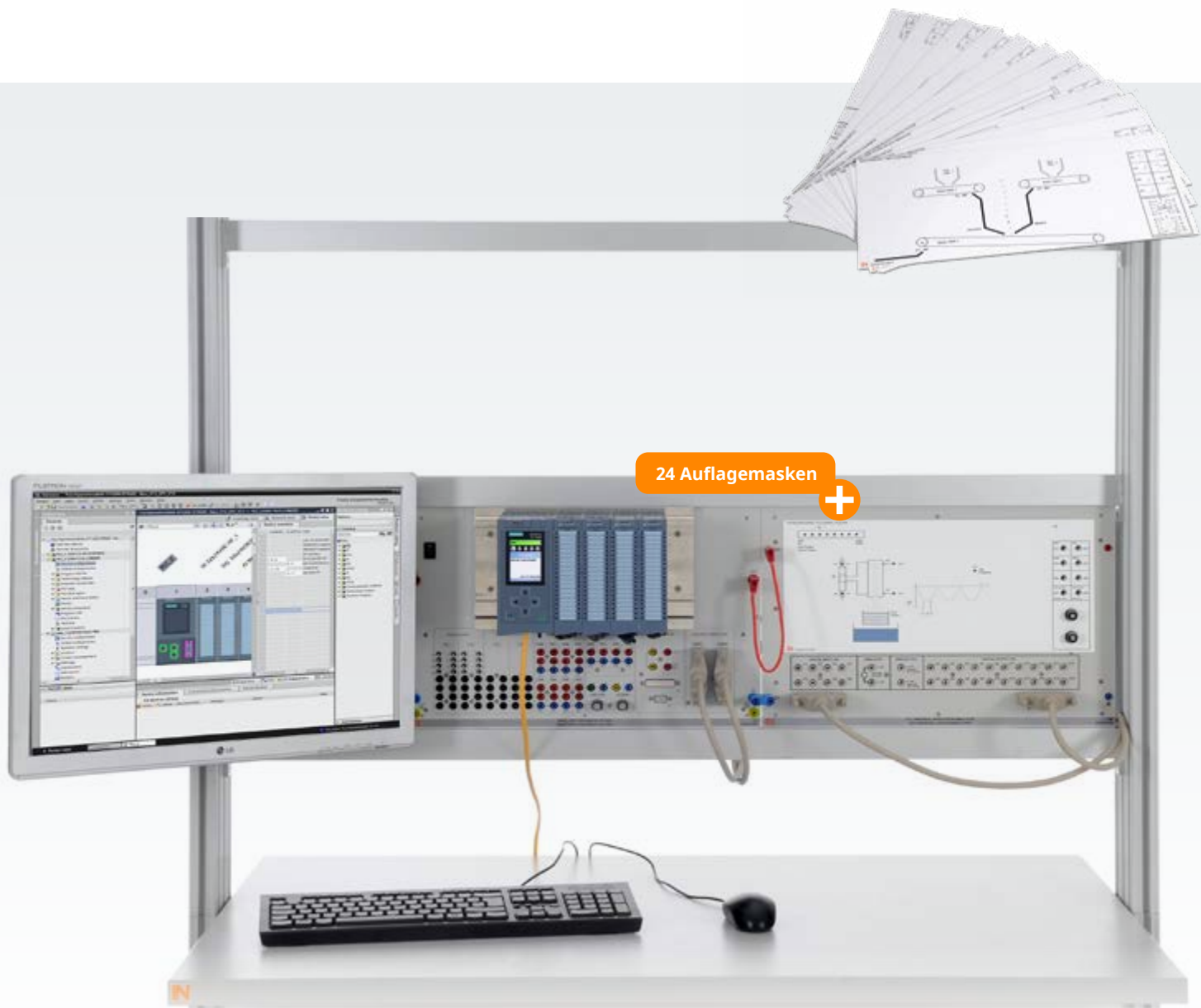
- Rules of conduct for the use of systems
- Physical measures
- Configuring a security LAN router
- DHCP Server • Firewall
- Open VPN
- Analyzing network protocols
- Secure Shell (SSH)
- HTTP(S)
- Remote maintenance with Sinema
- Access Control / Access restriction
- Authentication / Shares
- Encryption
- Certificates

A low-angle, blue-tinted photograph of industrial machinery, likely a factory or laboratory setting. The image shows complex metal structures, pipes, and a control panel with a screen and buttons. The perspective is looking up at the machinery, creating a sense of scale and complexity.

# APPLICATIONS OF AUTOMATION TECHNOLOGY

The areas of application of automation technology are very diverse and can be found in many sectors. Whether it is the networking of systems with different bus systems or applications such as elevators or gantry robots, automation technology always plays an important role there.

# UNIVERSAL PLC SYSTEM SIMULATOR



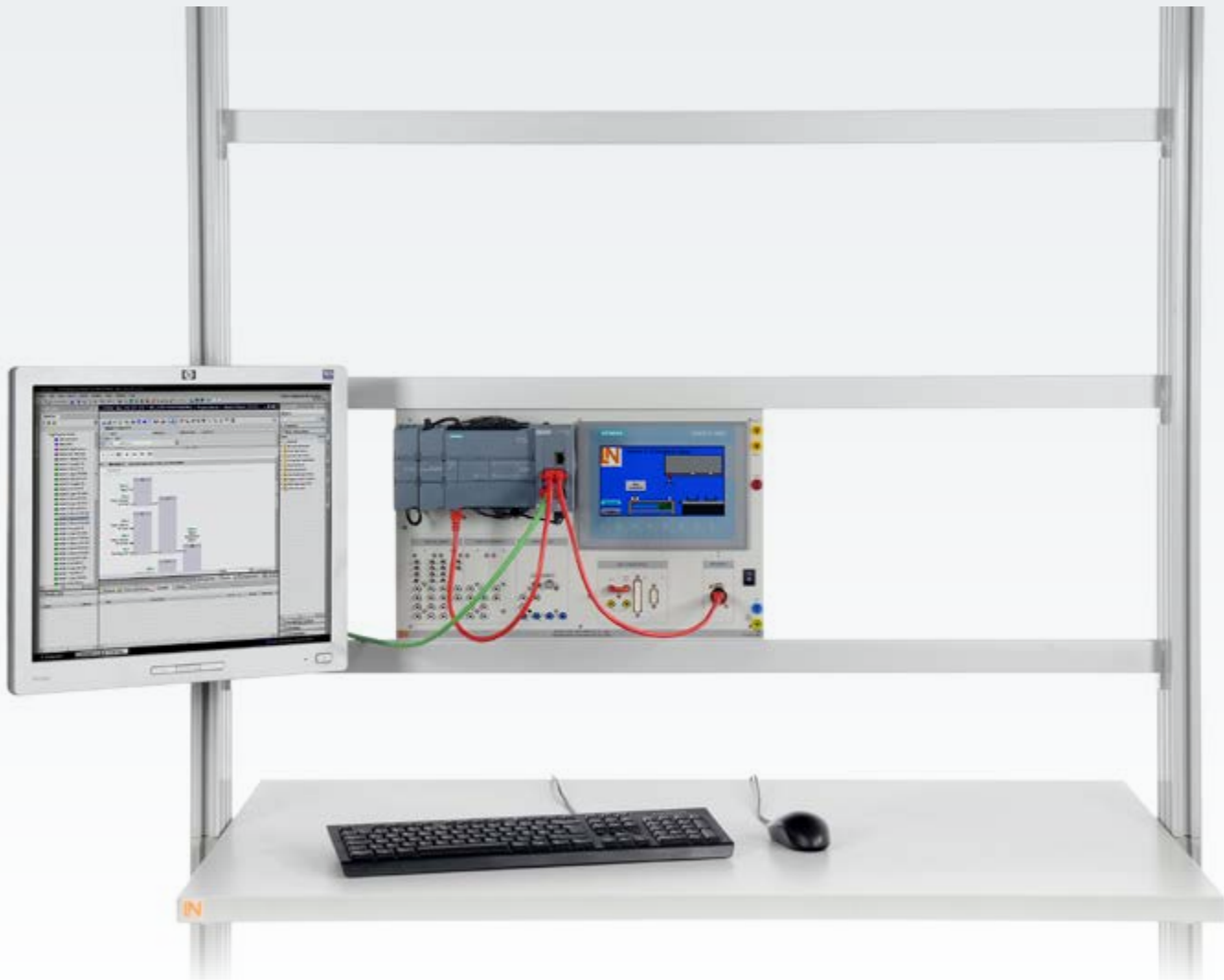
## Set up, switch on, practice

The Universal PLC System Simulator was specially developed for basic PLC training. It is excellently suited to illustrate control and regulation processes of industrial applications in a clear and practical manner. By using overlay masks, up to 24 different technical processes and models can be simulated. The projects are aligned exactly with syllabus requirements.

## Projects

- Construction site traffic light
- Star-delta start
- Dahlander circuit
- Starter control
- Monitoring device
- Container filling system
- Lock door control
- Transfer stage
- Buffer store
- Level control line
- Mixing plant
- and much more

# PLC TOUCH PANEL MODELS



## 8 models for getting started in the TIA Portal

The touch panel models are designed so that all basic functions of PLC programming are included. A self-learning course guides the user from data block programming through state and sequencer programming to controller design. The models are animated on a touch panel and controlled via the digital I/O of the connected PLC. As with real models, the programmer receives signals from the sensors here too, which are required for further processing in the step sequence.

## Projects

- Transport crane
- Construction site traffic light
- Container filling system
- Conveyor belt
- 3-floor elevator
- Star-delta starter
- Double 7-segment display
- Room temperature control

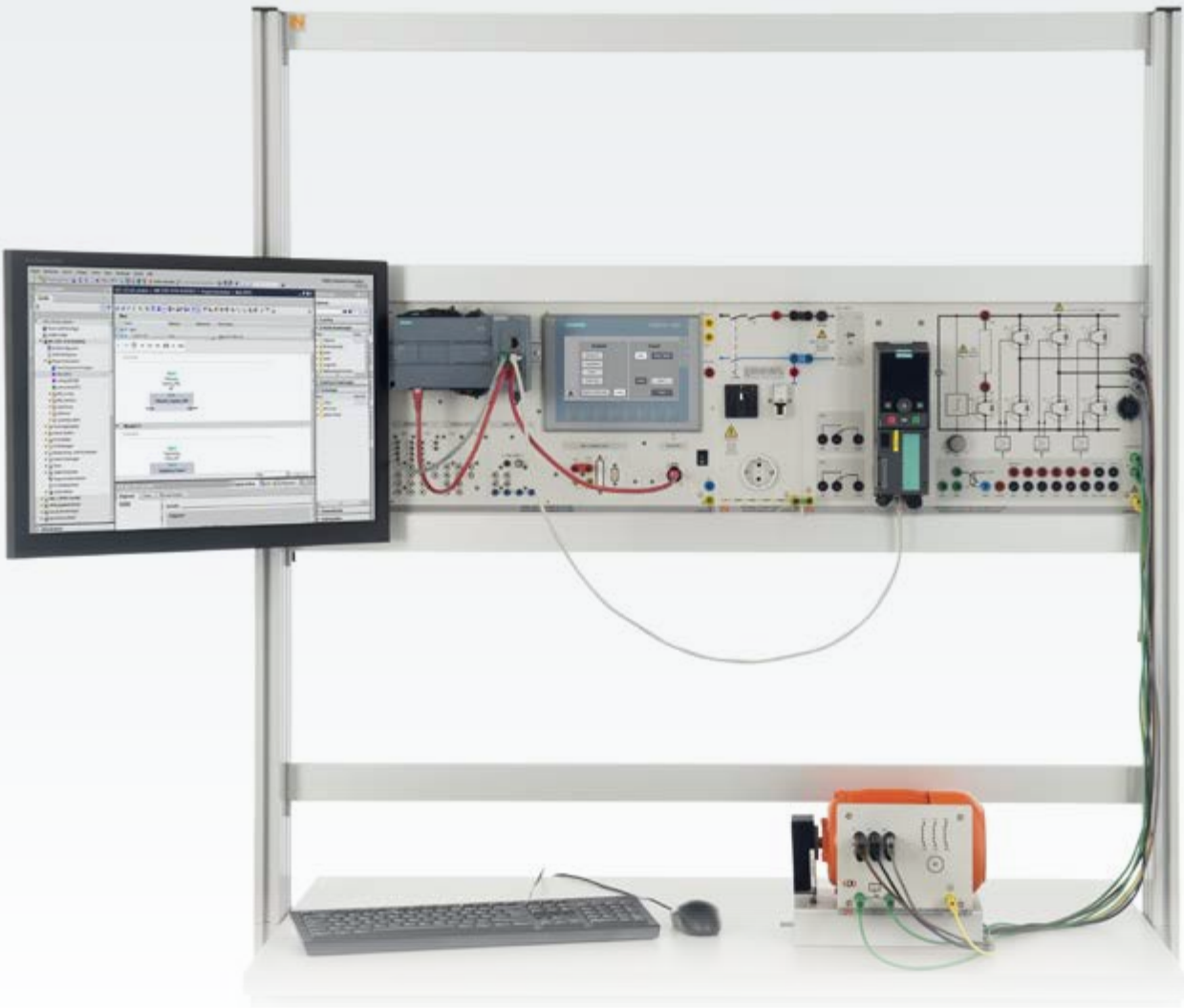


**IO-Link in manufacturing**

IO-Link is a globally standardized IO technology (IEC 61131-9) for communicating with sensors and actuators. This technology enables 'intelligent sensing'. The application possibilities of IO-Link are very diverse and play an important role, especially in Industry 4.0.

**Learning contents**

- Fundamentals of IO-Link
- Transport system with IO-Link Master
- Configuration in the TIA Portal
- IO-Link-RFID
  - Configuration
  - Project parcel sorting
  - Project keeping statistics
- IO-Link ultrasonic sensor
  - Project position determination
  - Project segment division
  - Project diagnostics
- IO-Link signal light
  - Project status display



**Connection between drive and automation technology**

The main focus of this teaching system is on the project planning and programming of the PLC and the operator panel as well as the commissioning and parameterization of the frequency inverter with PROFINET. To load the drive machine controlled by the frequency inverter, the servo brake is used in this teaching system. This allows various parameterizable working machines such as fans, winding drives, calenders, compressors, and a flywheel mass to be simulated.

**Learning contents**

- Parameterization, programming, and commissioning of a programmable logic controller
- Project planning and commissioning of a touch panel
- Parameterization and commissioning of a frequency inverter
- Project planning and commissioning of a fieldbus syst
- Networking the frequency inverter with the controller via PROFINET

## FUNDAMENTALS OF THE 3-AXIS GANTRY ROBOT



The gantry robot is used to perform pick & place or storage tasks with workpieces. Other tasks such as stacking workpieces, storage, tracing contours, etc., are also possible. With the help of the pen holder, pens can be fixed and used to draw figures or trace contours to simulate milling.

### Learning contents

- Basics for carrying out experiments
- Detailed experiment description
- Hardware configuration
- Projects:
  - Axis control in manual mode
  - Raster movements
  - Workpiece transport
  - Workpiece stacking
  - Path travel (circular movement)
  - Warehouse management

## 3D PRINTING WITH THE BAMBULAB P2S AND AMS2 PRO

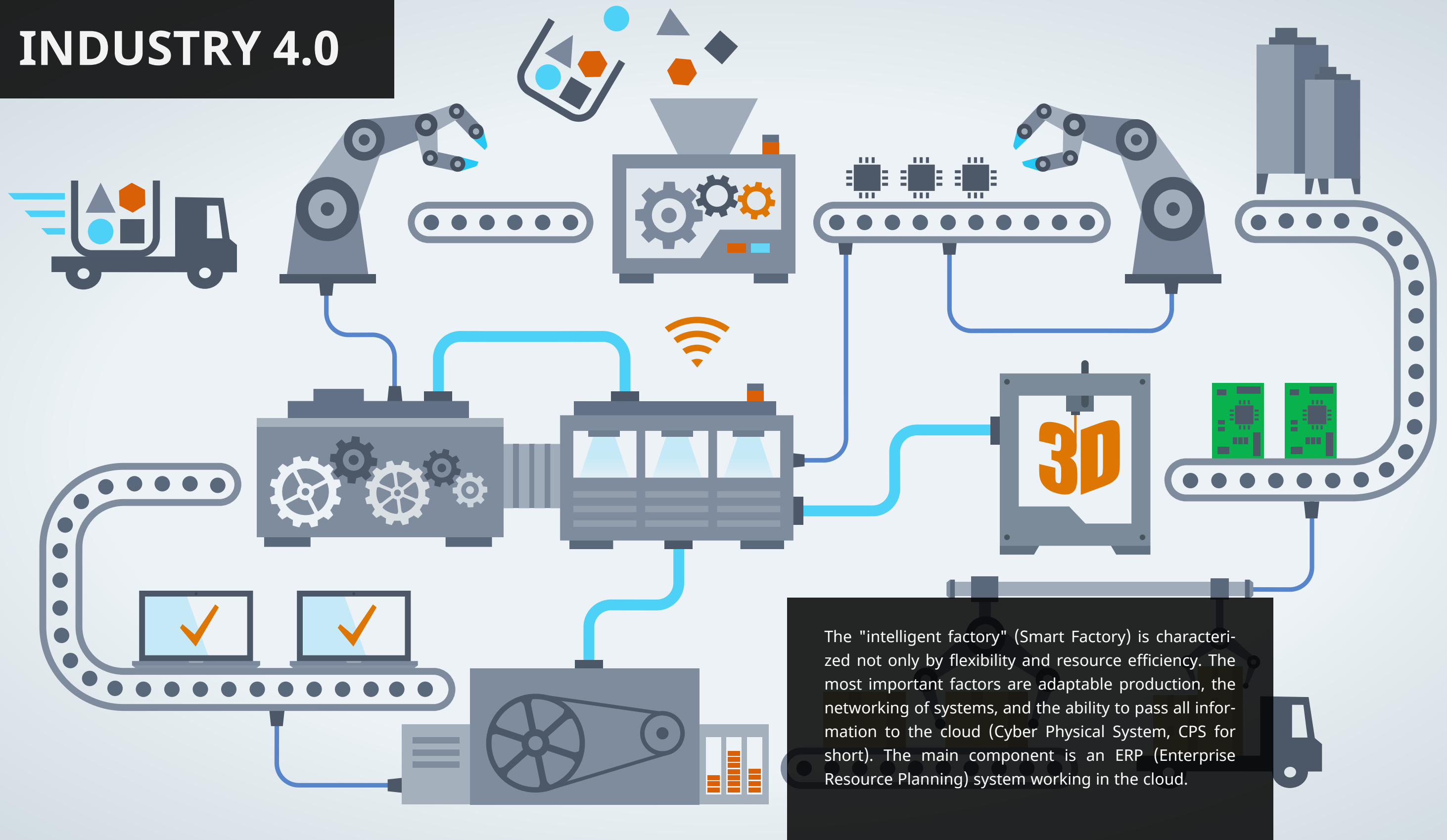


The powerful Bambulab P2S 3D printer with the automatic multi-material system AMS2 Pro enables an easy and safe entry into professional multi-material printing. Thanks to the closed housing with an integrated HEPA filter system, clean work in the classroom is possible without any problems. The printer can be operated both independently via the touchscreen and automatically via WLAN or Ethernet. The accompanying self-learning course comprehensively teaches the fundamentals of 3D printing and material processing with Bambu Studio. Projects can be created, prepared, and monitored directly in the software.

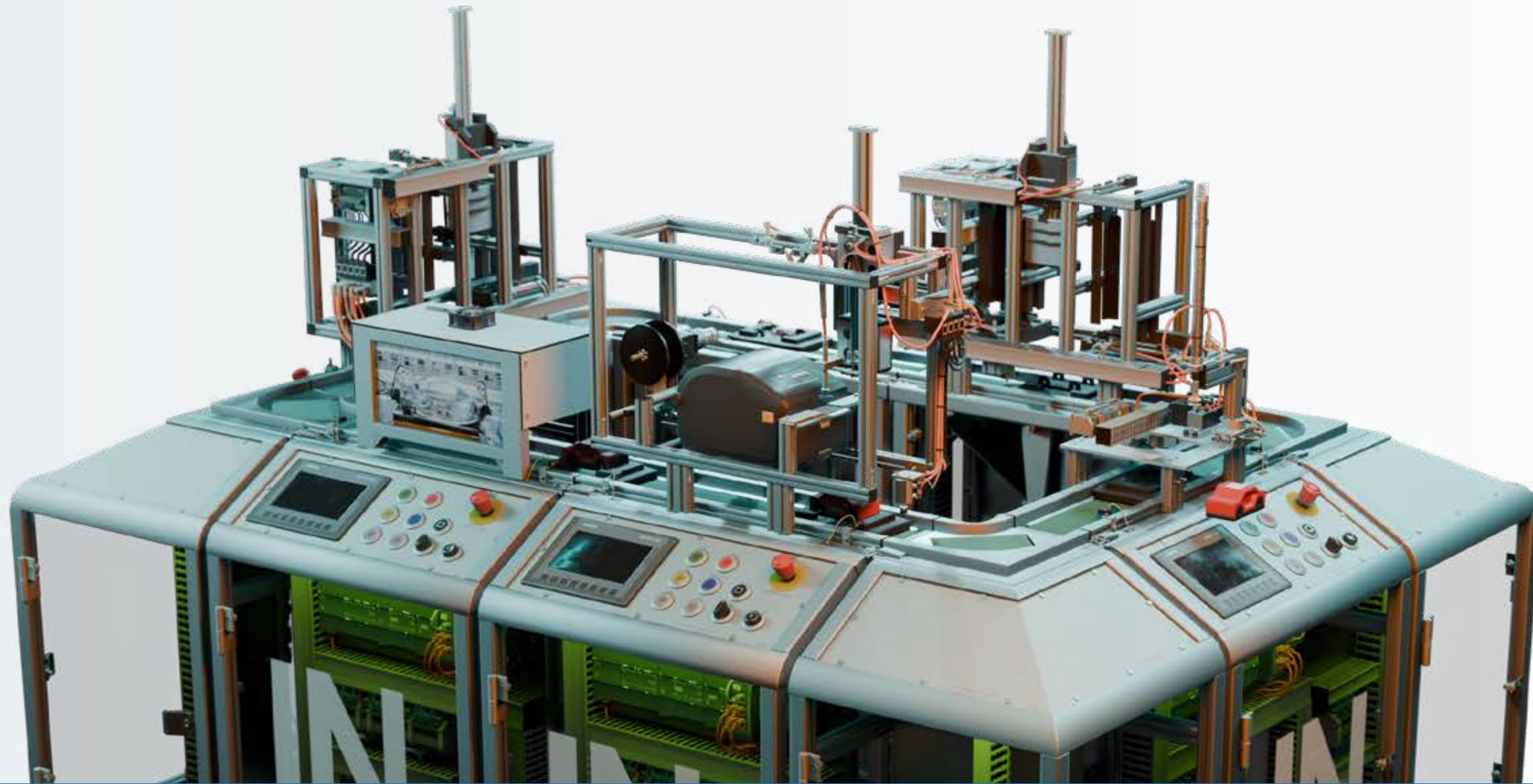
### Learning contents

- Fundamentals of the FFF 3D printing process
- Introduction to multi-material printing (AMS2 Pro)
- Automatic filament feed and change
- Print preparation and slicing with Bambu Studio
- Operation and maintenance of the printer
- Creating single- and multi-color prints
- Printing with water-soluble support material
- Optimizing print parameters
- Error detection and troubleshooting
- Networking and remote monitoring of the printer
- Practice-oriented project implementation
- Connection to Industry 4.0 applications

# INDUSTRY 4.0



# INDUSTRY 4.0 FOR EDUCATION



## One system - many possibilities

In the basic configuration of the Industry 4.0 production, many variants can be custom-manufactured. The expansion with MES and ERP systems ultimately makes the difference to Industry 3.0 and distinguishes this system.

## From subsystem to industrial plant

Starting education and further training with a complex production line can be a tedious process. Modularize the system into eight individual workstations. Network each of these single systems with the ERP-Lab to create Industry 4.0.

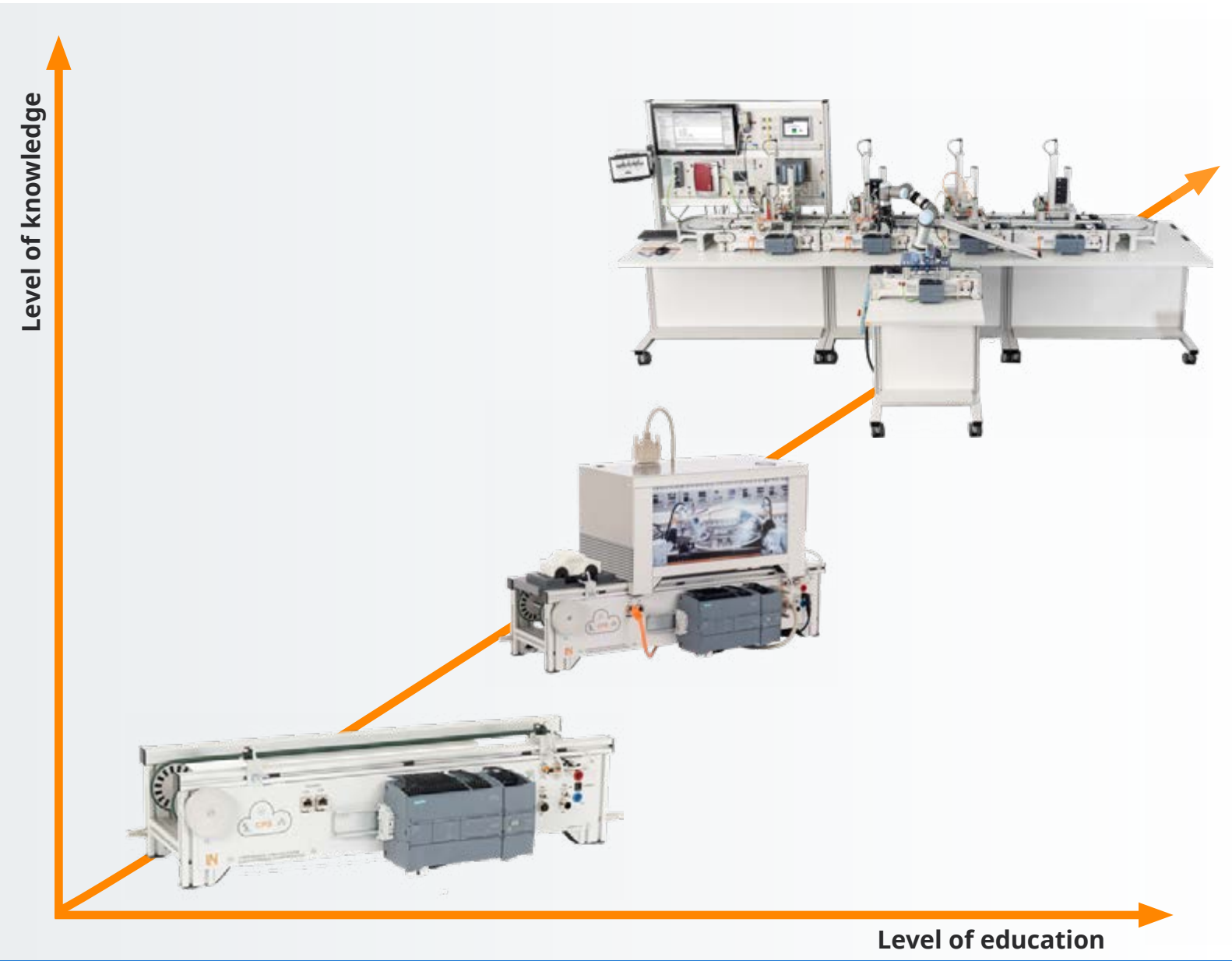
## Expansion possibilities

Thanks to its modularity, the system is highly flexibly expandable and meets every requirement. Whether it's connecting an Automated Guided Vehicle (AGV), integrating Augmented Reality (AR), or increasing the variety of variants with an intelligent manual workstation, there are no limits to the complexity.



Discover your 4.0 solution now!

# THE EDUCATION CONCEPT



## The Lucas-Nülle education concept

- Work on the same system from the beginning to the end of the training
- Increasing level of difficulty as training progresses
- Individual compilation of systems suitable for your lessons
- The matching LabSoft course in digital form for every equipment setup

## LabSoft

- One software to manage all your courses
- Courses with graphical presentation and practical tasks for every topic
- Learning progress monitoring and statistics
- Create your own courses or use and edit courses provided by us
- Create and manage your own questions, measurement tasks, tables, and diagrams

# INDUSTRY 4.0



Modern factories can be recognized by many things, both by the hardware used and the software. For example, in many highly automated production halls you will find industrial robots and increasingly collaborative robots, so-called cobots. Technicians maintain the machines using Augmented Reality. Sensors communicate with the controllers via increasingly intelligent protocols such as IO-Link. Even the manufactured products contain more and more information, which is stored on RFID tags and/or shared directly with the ERP via WLAN. This information and much more is evaluated and used in powerful software systems, the ERP systems. This enables the automated production of individual products according to customer requirements right down to a batch size of 1.

The Industry 4.0 systems from Lucas-Nülle use these technologies. Prepare your pupils and students for what awaits them in the industrial world, Industry 4.0.

# THE IMS CONVEYOR BELT SYSTEM



## The conveyor belt system

On the front of the system is a freely programmable Siemens PLC, which takes over the control of the module. In addition to various digital sensors and the motor for the belt drive, the belt features an IO-Link Master module, via which an RFID read and write device is connected. Further intelligent sensors can be connected. Various processing stations (see pages 8 and 9) can be controlled by the PLC via the 25-pin D-Sub connector. Two Ethernet ports are available as communication interfaces.

## The industrial mechatronics unit

The industrial mechatronics unit expands the functions of the conveyor belt system with a large control panel. The control cabinet allows the accommodation of various additional hardware. The system was designed so that plants can be set up and modified even easier and faster. This makes the installation of the compressed air supply, communication, and power supply even easier.

# THE INDUSTRIAL MECHATRONICS UNIT IMU



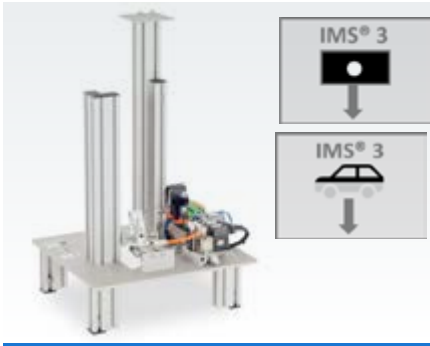
## Benefits of the IMU

- Control panel with HMI
- Programmable emergency stop
- System lockable via key
- Status display via LED strips
- Flexible hardware configuration
- Lockable door
- Air routing in the frame profile
- Connection of multiple systems via quick-release fasteners

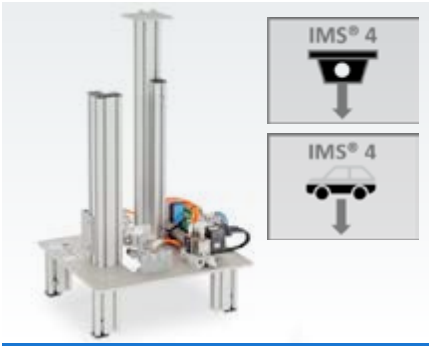
## Learning contents of both devices

- PLC programming with TIA Portal
- Reading out digital sensors
- Controlling the DC motor via PWM signals
- Working with intelligent sensors via IO-Link
- Profinet

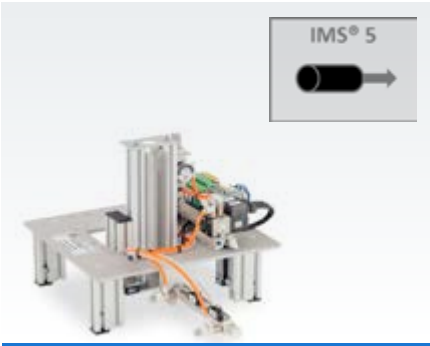
# THE SUBSYSTEMS AT A GLANCE



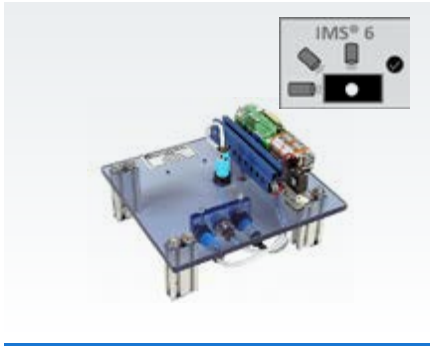
IMS® 3 Station Sorting



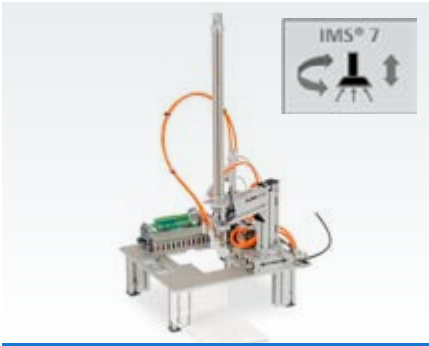
IMS® 4 Station Assembling



IMS® 5 Station Processing



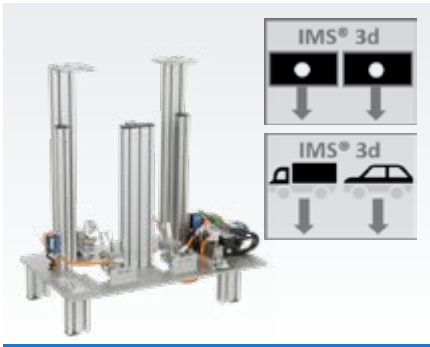
IMS® 6 Station Testing



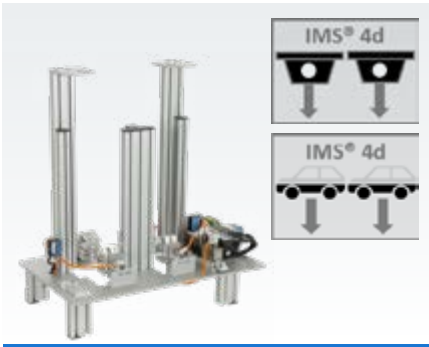
IMS® 7 Station Handling



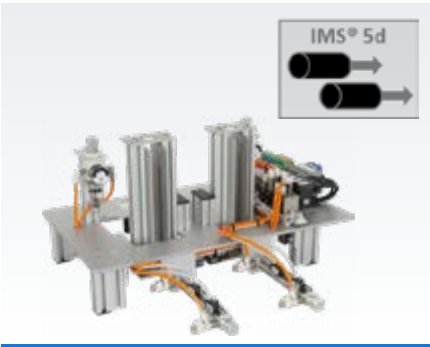
IMS® 8 Station High-bay warehouse



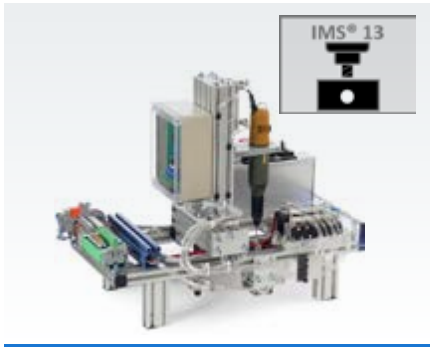
IMS® 3d Double station Sorting



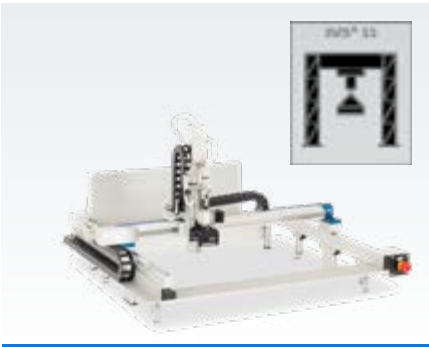
IMS® 4d Double station Assembling



IMS® 5d Double station Processing



IMS® 13 Station Drilling and milling



IMS® 15 Station Gantry robot



IMS® 16 Station Painting

## Modularity

The modularity of the system allows for numerous combinations and project variants. Adapt the setup and complexity to your needs and teaching situation. The robust design of the stations allows for the trouble-free assembly and disassembly of a system. The connection to the conveyor belt and the power supply is made via a D-Sub plug.

## Compatibility

The stations are compatible with both the IMS conveyor belts and the IMU units and can be used for car production as well as block production.

## Industrial and practice-oriente

Almost all components are industrial parts. This helps learners to quickly find their way around in their professional lives.



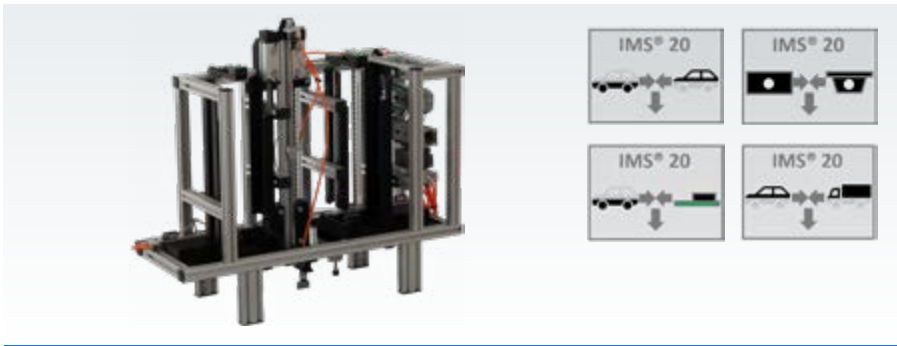
IMS® 17 Station Labeling



IMS® 18 Station Camera inspection

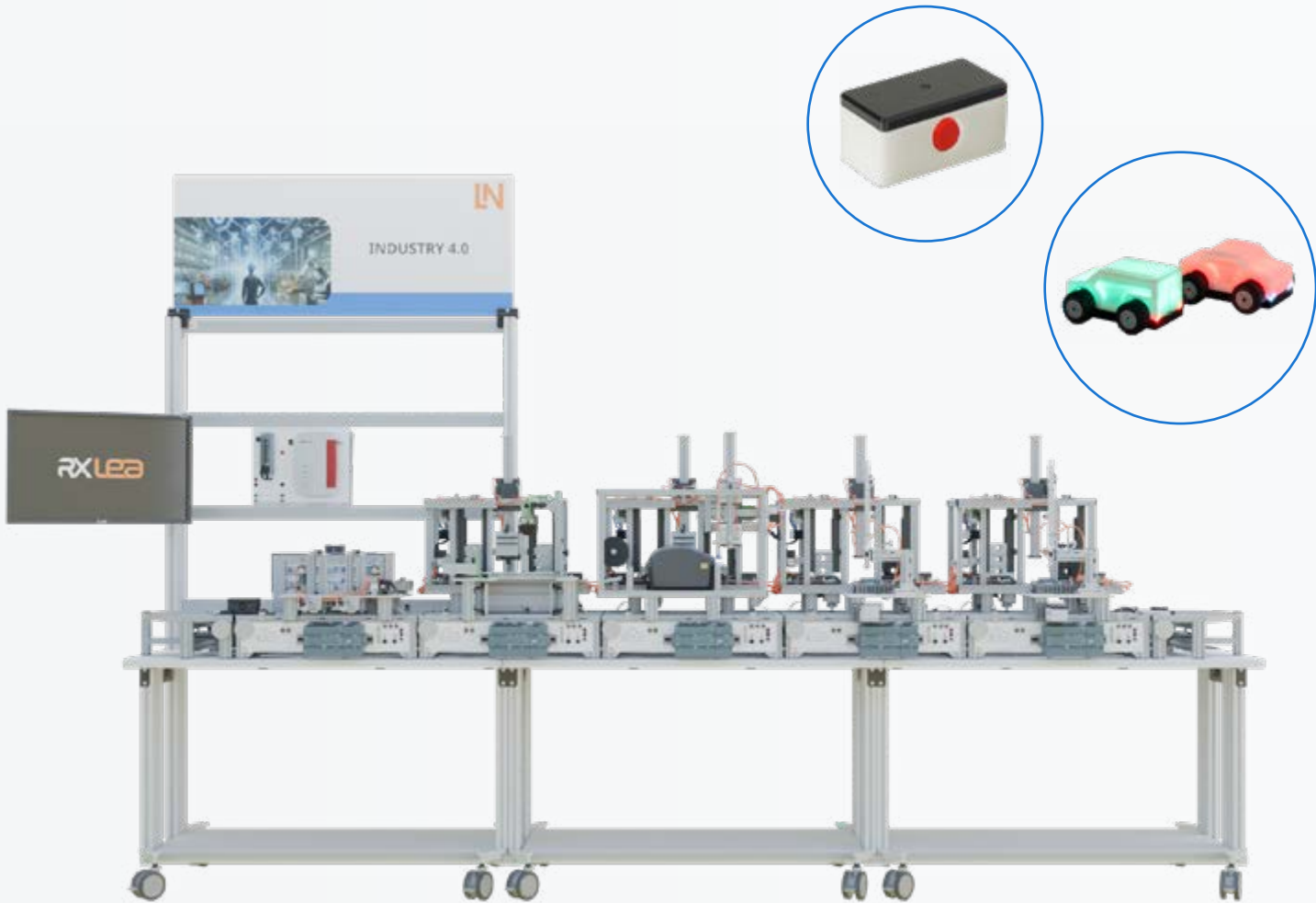


IMS® 19 Station Camera inspection with AI system



IMS® 20 Station Guided assembly

# PRODUCTION LINES CBP AND CCP



## Manufacturing plant

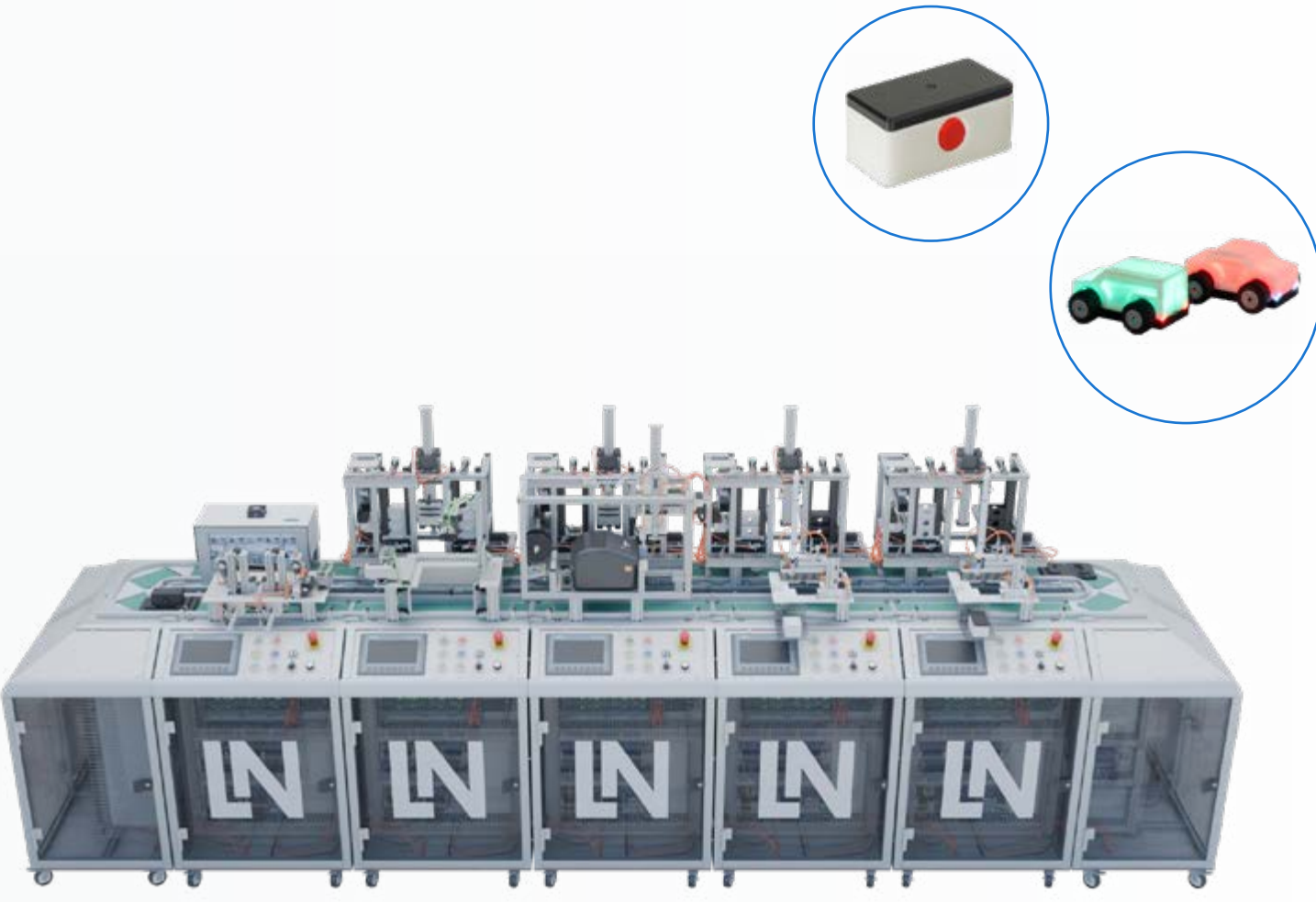
The production lines are assembled and connected from individual modules. Use the handy conveyor belt system (IMS) or the unit in industrial design (IMU) as the basis of your system and produce a large number of product variants of the individual products Car and Block.

## From subsystem to industrial plant

Starting education and further training with a complex production line can be a tedious process.

**Modularize** the system into individual workstations to teach the fundamentals. Network the belts via Profinet for operation as an overall plant. Operate the plant as a conventional Industry 3.0 production. Add the ERP-Lab to achieve networking at Industry 4.0 level.

# PRODUCTION LINES UBP AND UCP



## Expansion possibilities

Thanks to its modularity, the system is highly flexibly expandable and meets every requirement. Whether connecting an Automated Guided Vehicle (AGV), integrating Augmented Reality (AR), or increasing the variety of variants with an intelligent manual workstation, there are no limits to the complexity.

## Benefits

- Equipment variants for every budget
- Teach on systems with industrial components and standards
- High modularity
- Quick assembly and disassembly
- ERP, OPC UA, Profinet, PLC
- Accompanying course software for every sub-aspect

# FROM THE IMS®-SUBSYSTEM TO INDUSTRY 4.0



**MES**  
MANUFACTURING  
EXECUTION  
SYSTEM



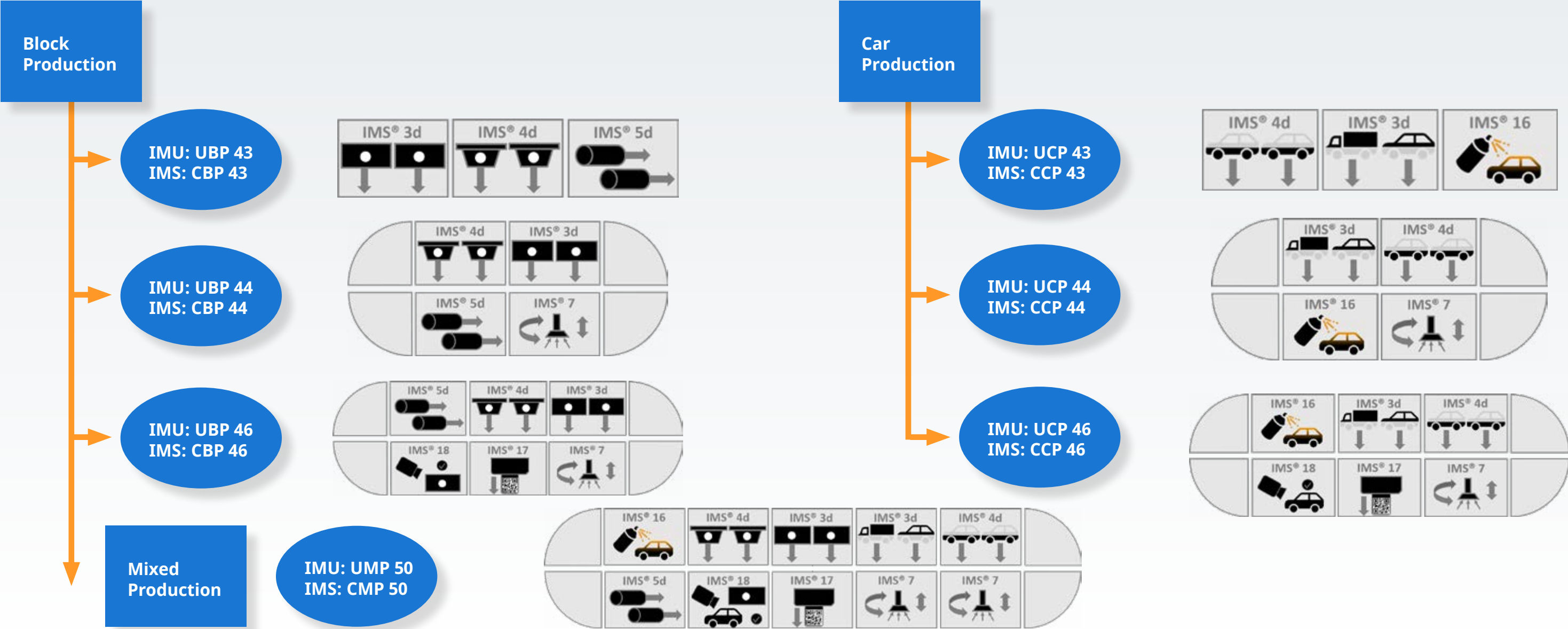
## Flexible design

Thanks to the system's modularity, the transport systems with the processing stations can be put together very flexibly. Complete production lines can be set up in just a few minutes and, adapted to flexible teaching, dismantled again.

## Adapted to the budget

The purchase can be made in stages. Start with minimal equipment and expand your system to a complex production facility at any time. A few examples of ready-designed production lines can be found on our homepage.

# INDUSTRY 4.0 EQUIPMENT



## Start small

The Lucas-Nülle production plants are available in sizes and equipment variants for every need and every budget. Start with just 3 belts as a fully-fledged production line for blocks or cars with a large variety of variants and control your plant classically via PLC using Profinet or network it with the ERP-Lab. Expand smaller lines step by step with additional stations for sorting out, labeling, or quality control.

## Blocks or Cars?

Both! If you already own a block production line, you can re-equip it for car production with just one additional station (painting) or build a new production line for manufacturing both blocks and cars.

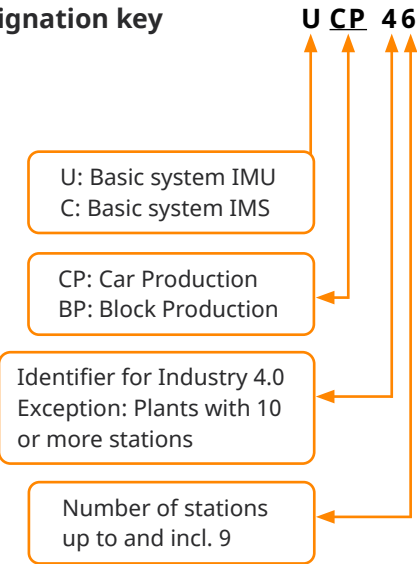
## An ERP system for all configurations

Configure all shown and further equipment setups in the same ERP system. Expanding or converting your existing plant can be done in a few steps. All your data and orders will remain intact.

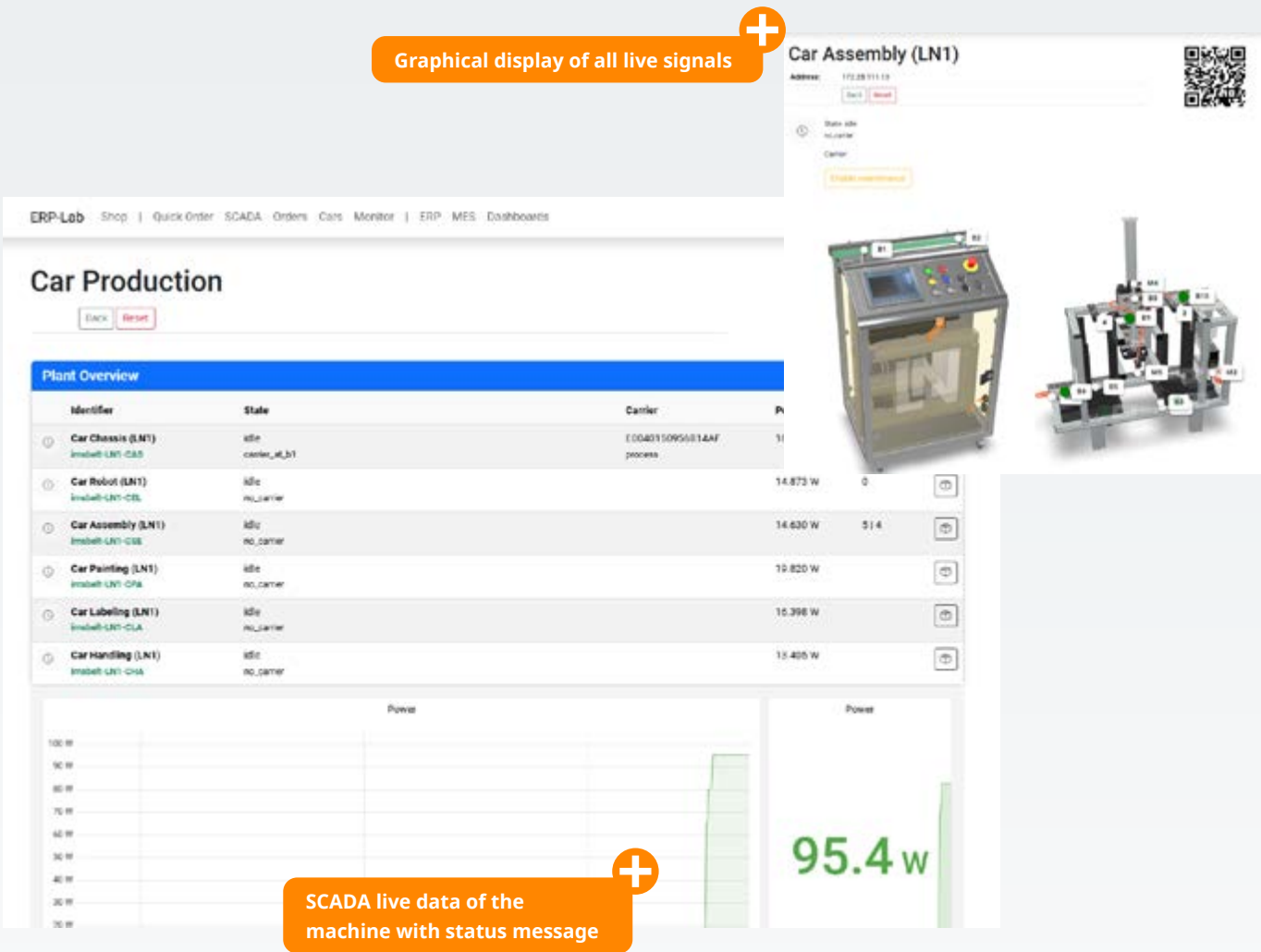
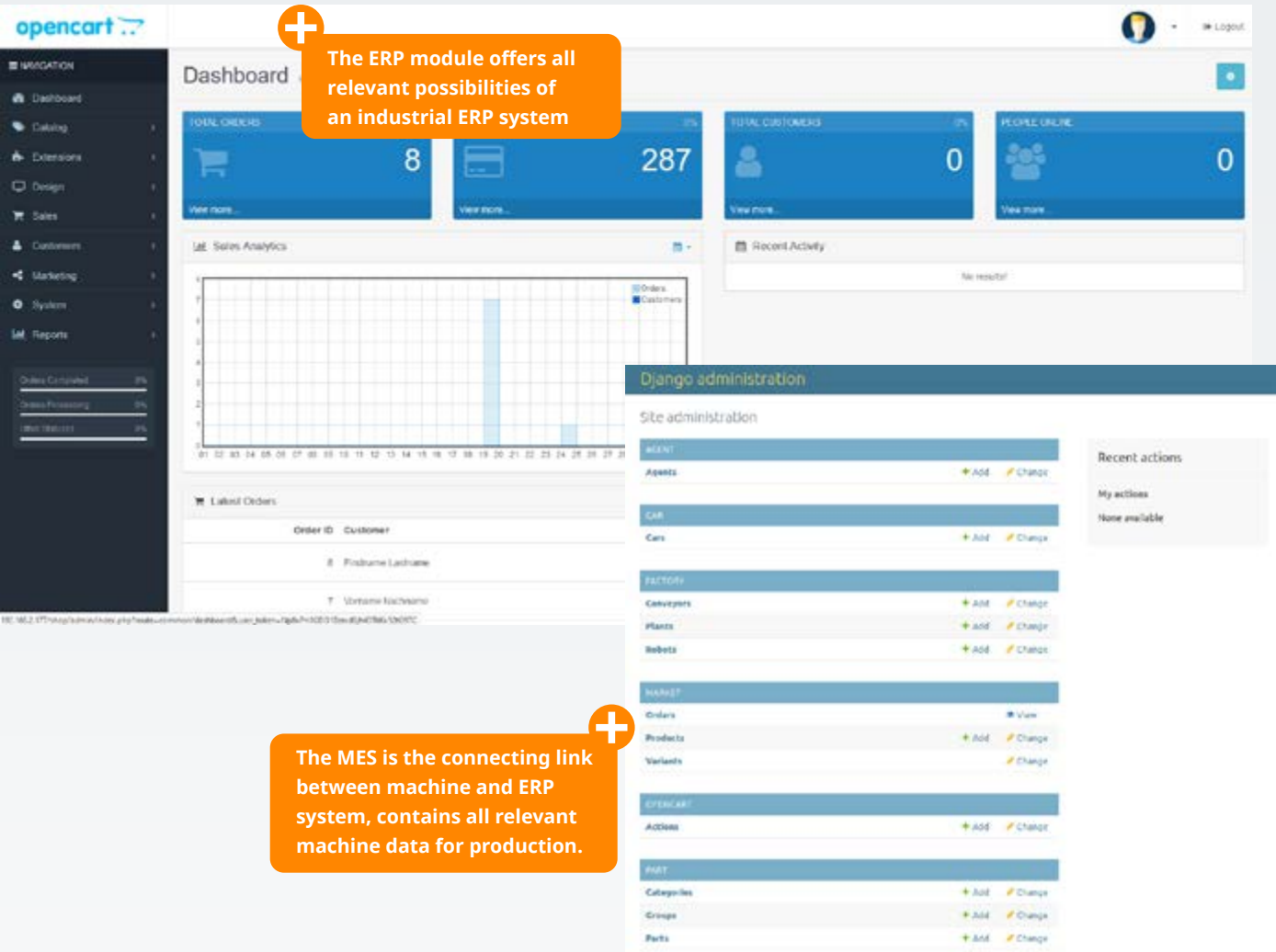
## Advantages

- Configurations tailored to budget, space, and content
- Flexibly expandable or convertible
- Control via PLC (I3.0) or ERP-Lab (I4.0)
- One ERP-Lab for everything (No additional software costs when expanding)

## Designation key



# EVERYTHING UNDER CONTROL WITH THE ERP-LAB



## The didactic alternative to industrial system solutions

The ERP-Lab maps all central functions required for the implementation of modern Industry 4.0 concepts. With the integrated software components SCADA, MES, ERP, and a web-based shop, a continuous, digitally networked process landscape is created.

Whether additive manufacturing, automated production, or networked manufacturing systems – the ERP-Lab forms the central element of the entire environment. It links all modules of the laboratory into a holistic system. Additional modules can be flexibly integrated and expanded at any time.

The integrated webshop is – like all system components – freely configurable and enables internet-based order entry.

Orders are transferred directly to the ERP system, processed there, and handed over to the MES as production orders. Manufacturing then starts automatically and transparently.

## Focus on didactics

The interaction of the individual system levels is conveyed practically and understandably in the associated LabSoft courses. Learners can trace all configurations and process steps, thereby acquiring a well-founded understanding of digitally networked production processes and modern value chains.

# AUGMENTED REALITY (AR) WITH THE IMS FACTORY APP



## AR in production

In times of Industry 4.0 and ever-advancing technological development, modernization in the area of maintenance is indispensable. Not only observing the operation of the production facility, but also manual intervention and control of a process must be possible via new technologies.

## Learning contents

- Introduction to Augmented Reality
- Communication between PLC and AR App
- Display of signal states in real-time
- Control of the hardware via App
- Free positioning of signals in the AR environment
- Configuration of error messages
- Free use of PLC signals for other applications as well

# FURTHER EQUIPMENT | CAMERA INSPECTION WITH ARTIFICIAL INTELLIGENCE



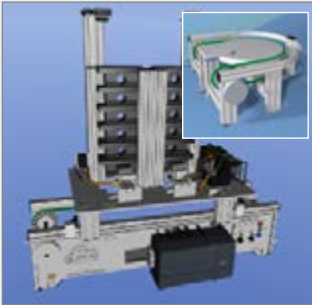
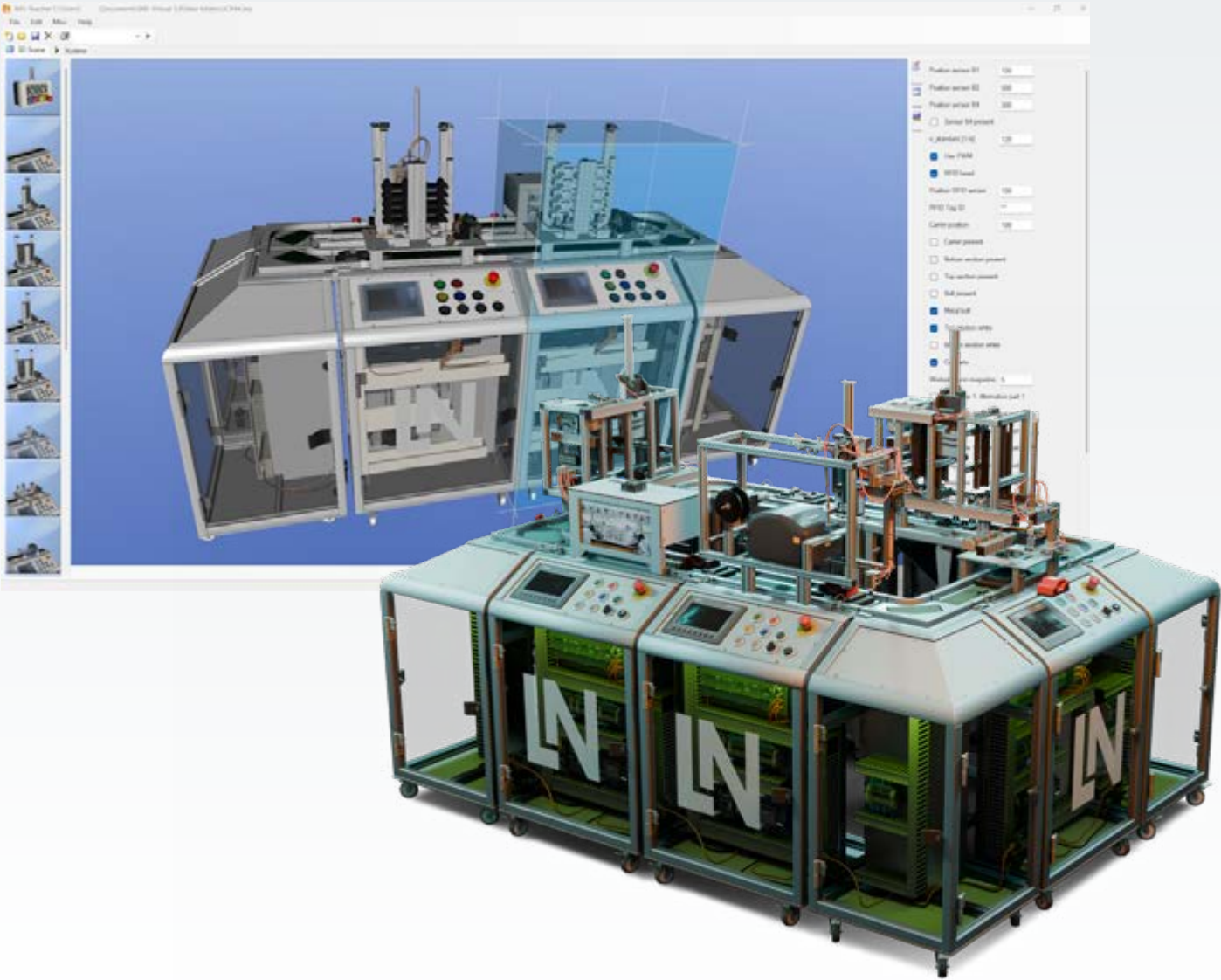
## Quality control with AI

Quality control is of crucial importance in the manufacturing of products and components. More and more industries are relying on automated quality control with artificial intelligence to ensure high utilization, efficiency, and accuracy at low costs. The LN system Camera Inspection with AI includes, in addition to the station with an industrial camera, an AI control unit with an NVIDIA computing unit for training the models.

## Learning contents

- Application and optimization of self-learning algorithms
- Generating data sets
- Training the model
- Optical quality inspection
- Use in the overall Industry 4.0 plant

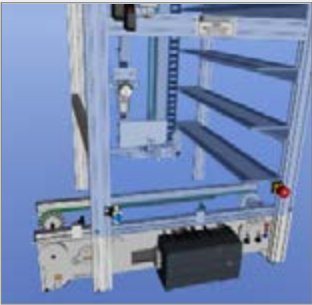
# IMS® VIRTUAL – THE DIGITAL TWIN



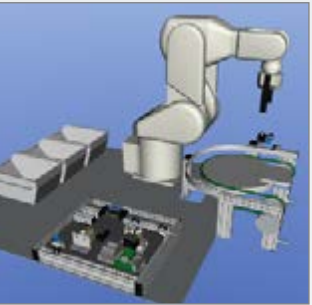
IMS® 4 –  
Double Station Assembling



IMS® 7 – Handling



IMS® 8 – Storing



IMS® 11 –  
Industrial Robot IMU



IMU® 3 – Separating with  
Car Production



IMU® 4 – Assembling



IMU® 6 – Testing



IMU® 16 – Painting

The images shown represent exemplary selected stations of the Lucas-Nülle Smart Factory. All stations of the IMS® and IMU® product families, including block and car production, are fully available in IMS® Virtual.

## The "Digital Factory": Realistic, dynamic 3D representation

IMS® Virtual is a PC-based, graphical 3D simulation system that provides the virtual learning environment for the mechatronic training system IMS®. The virtual sub-systems and production lines are represented with all components as a dynamically animated, virtual 3D scene in real-time. This 3D scene is programmed like the real models with STEP 7 and controlled via the "S7 PLCSIM" software.

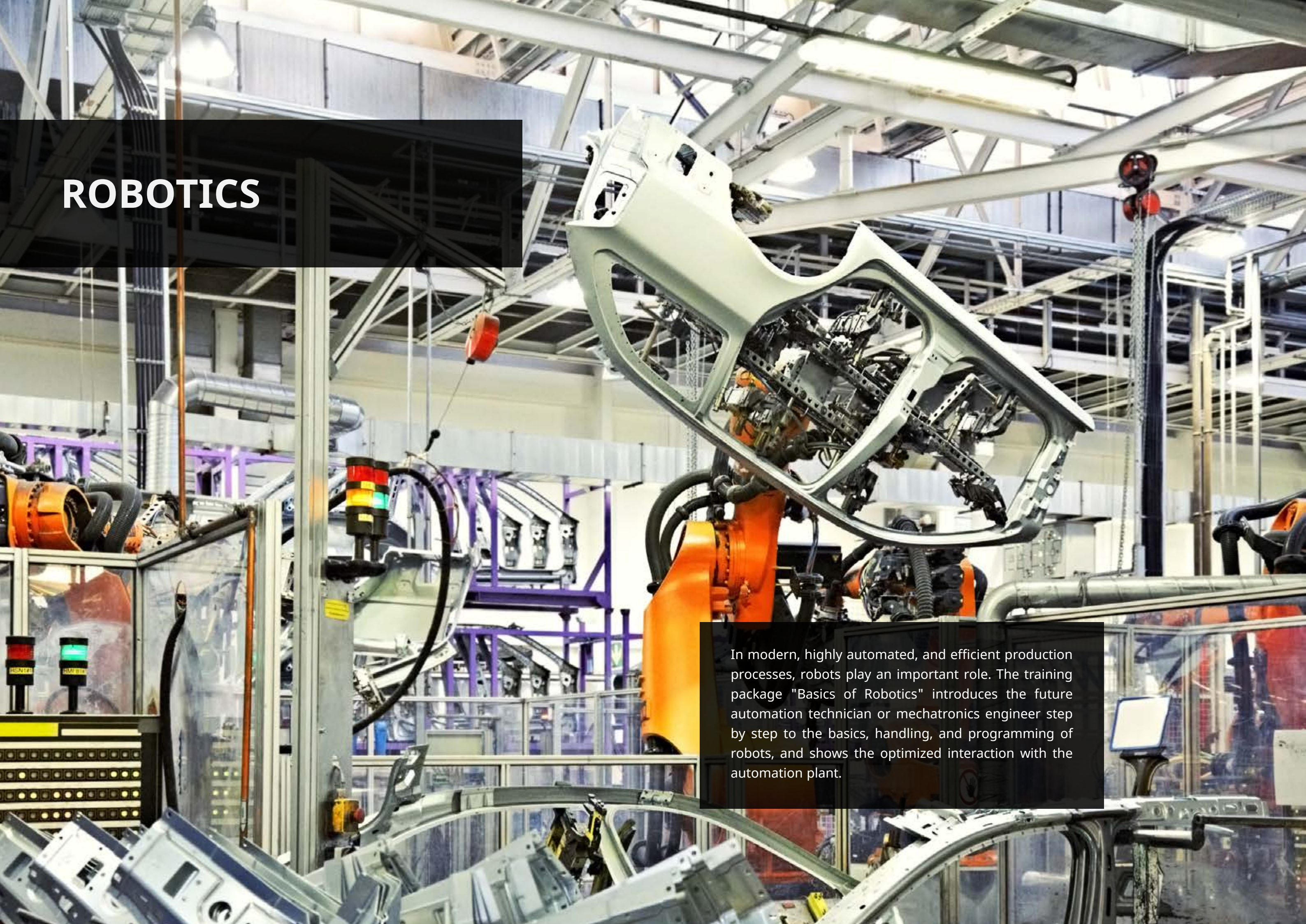
## New Features in IMS Virtual Version 5

- Integration of the latest IMS & IMU systems
- Single and double stations
- Car production
  - Integration of RFID
  - Ultrasonic sensors
  - PWM control
  - OPC-UA communication
  - Connection to ERP system
  - Use of real and virtual PLCs possible

## Learning contents

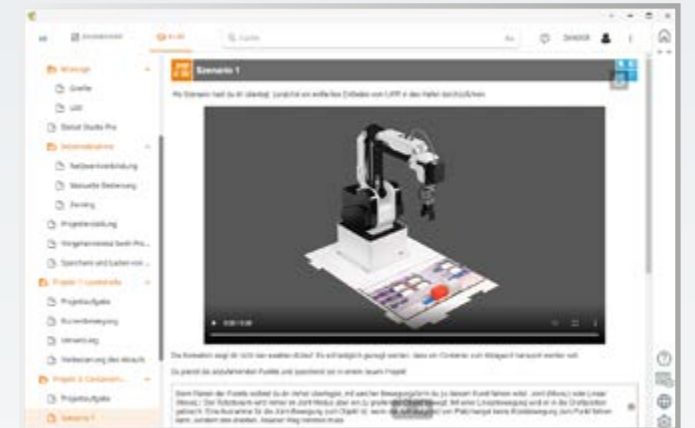
- Simulation and visualization of technological processes
- PLC programming according to IEC 1131-1 (IL, LAD, FB)
- Control and testing of technical processes
- Parameterization, programming, and commissioning of technologically diverse plants
- Execution of systematic troubleshooting on production plants
- Central operating and monitoring of plants and processes
- Getting to know the functionality and system structure of a production plant
- Developing the functionality of an industrial robot in a production plant

# ROBOTICS

A large industrial robotic arm, painted orange, is shown in a factory setting. It is holding a large, white, curved metal component, likely a car door or fender. The background shows a complex industrial environment with various pipes, structural beams, and other machinery. The lighting is bright, typical of a factory interior.

In modern, highly automated, and efficient production processes, robots play an important role. The training package "Basics of Robotics" introduces the future automation technician or mechatronics engineer step by step to the basics, handling, and programming of robots, and shows the optimized interaction with the automation plant.

# TRAINING SYSTEMS FOR ROBOTICS



## Entry into the world of robotics

Robots play a central role in modern, automated, and flexible production environments. The training package "Basics of Robotics" with the Dobot MG400 introduces prospective automation technicians or mechatronics engineers step by step to the operation, programming, and integration of collaborative robots. Realistic production sequences are simulated practically, and basic knowledge is conveyed.

## Advantages

- Multimedia-based learning environment with theory transfer, animations, experiment instructions, and evaluations
- Complete introduction to the operation of collaborative robots and their safety features
- Intrinsically safe operation (no additional safety measures required)
- Extensive practical exercises with the 4-axis robot, gripper, LED, and project masks
- Programmability via intuitive software
- Easy transfer of the learned knowledge to industrial robot systems

## The training system

The Dobot MG400 is a compact, collaborative 4-axis robotic arm for education in schools and universities. Realistic automation scenarios can be implemented and experienced directly with the Dobot MG400. The robotic arm combines the theoretical content of physics, mathematics, and computer science with illustrative, practical applications. Through its four serial axes, a wide variety of motion sequences can be realized precisely and simply.

## Learning contents

- Manual control and teach-in
- Programming basic motion sequences
- Coordinate systems and reference points
- Speed and acceleration control
- Analysis of singularities and symmetries
- Use of digital inputs and outputs
- Basic programming methods and structures
- Collaborative safety concepts
- 5 project scenarios

## COLLABORATIVE ROBOTICS



### Collaborative Robot UR3e

The UR3e from Universal Robots is a compact, collaborative robot characterized by simple programming, fast commissioning, and high operational safety. Thanks to the intuitive user interface, even inexperienced users quickly learn the basics of robot programming.

Programming is done, among other things, via manual guidance (teach-in): The robotic arm is manually guided to the desired position, and the corresponding waypoints are taken over directly. This allows programs to be created quickly, intuitively, and practically.

### Advantages

- Electric gripper with adjustable gripping force from 3 N to 40 N
- Adjustable gripper stroke up to 110 mm
- Camera system for object recognition: taught-in objects are safely recognized and gripped independently of their position
- Freely movable robotic arm for easy setup and programming
- PROFINET interface for connection to a PLC
- High safety standard: safety functions approved by TÜV NORD
- Tested according to EN ISO 13849-1, Category 3, PL d and EN ISO 10218-1

## INDUSTRIAL ROBOT



### CRK 10 – Robot programming with industry standard

The Kuka KR6 R700 sixx is a 6-axis industrial robot with which professional working, controlling, and programming are possible. An easy entry into programming is guaranteed by the clearly structured Teach Pendant. Via a direct PC connection over Ethernet, projects can be transferred between the robot and PC..

### Advantages

- Compact, fast handling robot from the industrial environment with 6 degrees of freedom
- Professional learning system: enables realistic learning
- International automotive standard: corresponds to the usual industrial setup
- Programming via Teach Pendant
- Project planning via supplied software possible
- Connection to PLC via PROFINET



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