IPA
Industrial Process Automation

From the Automatic Control of Individual Controlled Systems to Flexible, Full-scale Process Automation

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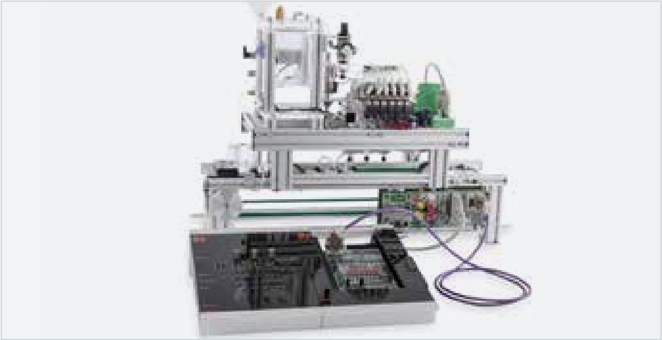
A more complex world of training and education
Radical changes in the way people work have revolutionised the requirements and needs of how information and skills are now conveyed and trained. As changes occur in company and factory processes, more and more importance is assigned to such topics as "operational competence" and "the design of individual work processes" in day-to-day practice.

Integrating thought and action
Today people being trained as process engineers receive a broad "skills set" and qualifications in the most varied of technical disciplines. Performance objectives cover training in the assembly and mounting of system components and machinery, as well as practical applications such as installation, operation and even maintenance of processes, for which an understanding of the entire system is a prerequisite.

Changing didactic approaches
These factors emphasise the need to put process engineering training at the heart of vocational education. As such, the theory of the subject is embedded in hands-on practical training situations which leads to successful retention. By working with complex process engineering training systems, the student and trainee are given an easier introduction to industrial practice.

Modular design
The IPA system has a modular design so that functional systems covering the widest range of sizes can be designed. All of the sub-systems can be deployed individually or in any combination. For sixpack transport between individual sub-systems, a double conveyor belt system is used on which workpiece carriers travel.



Reflection of reality
With this training system, the automatic industrial control systems and processes of a complex process engineering production plant are realistically simulated. The system exclusively employs industrial-type actuators and sensors. Furthermore, only industrial-type PLC systems with PROFIBUS and decentralised peripherals are used for open-loop and closed-loop process control.

Developing skills and expertise
The system's self-learning sessions promote the training of skills and expertise during actual teamwork and enable the students and trainees to acquire the basics needed for mastering process engineering systems. Each sub-system has been specially designed so that skills and knowledge are acquired gradually step-by-step right up to the point where a complete and sophisticated automatic control program has been created.

Your benefits

- Practical training using real industrial components
- Process technology sensors for different variables
- Can be combined with any open-loop or closed-loop control system from industry or education
- Can be expanded as desired with additional IPA stations and IMS® (Industrial Mechatronic System)
- Modular design permits quick and easy assembly
- Safer experimentation environment without leakages or loss of fluids
- Immediate start up thanks to minimum wiring
- Explore and understand how a process works
- Operation and monitoring via touch panel

Training Towards Industrial Standards

Simple Process Control

Controlling the individual work steps on a production line in order to put the entire system into operation is a process of some complexity. Therefore, achieving rapid setup and installation is an important objective in training. By employing self-paced study using the UniTrain-I system and the Siemens SIMATIC S7-300, your students are optimally prepared for the task at hand. UniTrain-I offers a simple, didactically structured introduction to the control of each sub-system and forms the preparation for process and automatic control of production lines with standard industrial equipment using the Siemens SIMATIC S7-300.

- **UniTrain-I**
  (Course work + experimenting + process control)

  With the aid of animations and numerous experiments conducted on real systems, various courses enable you to explore the fundamentals, principles and attributes of components used in automated process engineering and production plants. In a large number of practical experiments, controlled systems are studied, step responses are investigated and control loops optimised. In real experiments, students are trained how to handle and operate important tools and aids such as Bode diagrams and locus curves.

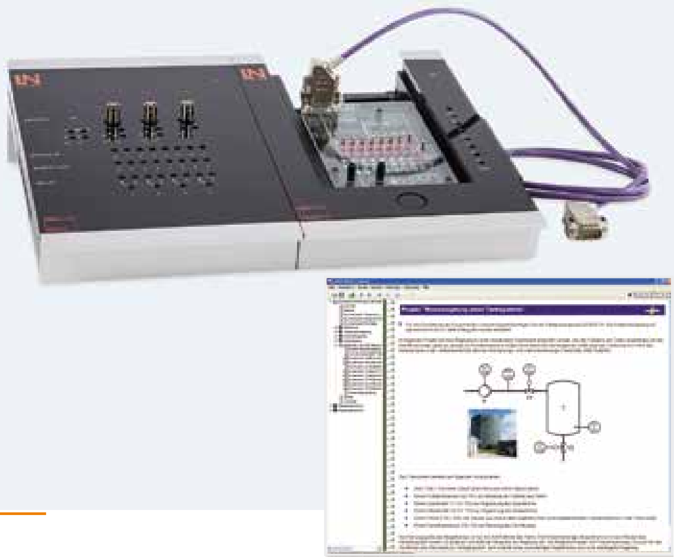
- **Siemens SIMATIC S7-300**
  (Process control with standard industrial equipment)

  An entire production line comprising individual sub-systems can be controlled using, for example, the SIMATIC S7-300 including the Touch Panel TP177 from Siemens. This level of process control precisely reflects the realities found in industry.

Your benefits

- **UniTrain-I**
  - Multimedia-based self-study course
  - Including control system with PROFIBUS
  - Fast progress due to extremely rapid setup
  - Integrated development platform

- **Siemens SIMATIC S7-300**
  - Process control of the entire production line with standard industrial equipment
  - Communication via PROFIBUS, PROFINET, PROFIsafe and AS-i
  - Industrial PLC
  - Use of STEP 7 as well as decentralised peripherals
  - Touch Panel operation



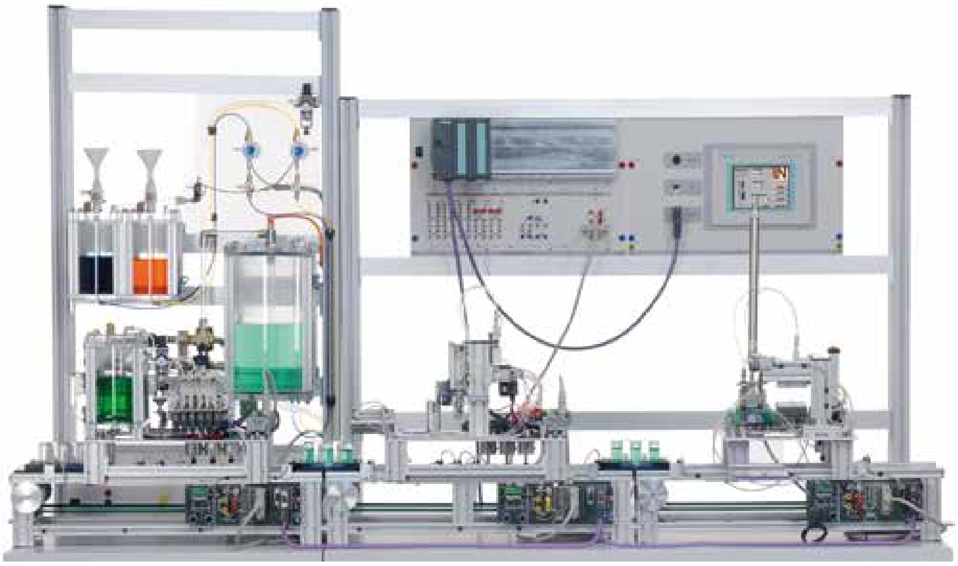
Rapid Setup and Installation Guaranteed

UniTrain-I self-study system

- Small groups of students each set up and learn to operate a sub-system with the UniTrain-I control system
- Thanks to extremely fast setup times, the students can be implementing their **first PLC program within 10 minutes**
- By using the accompanying multimedia-based self-study course, the instructor has **more time to provide individual instruction** to students and groups

Siemens SIMATIC S7-300 control system

- A complete class of students can set up and operate a full-length IPA production plant with the SIMATIC S7-300 control system and Touch Panel
- Consequently the students are able to learn hands-on how to perform **process control** of a production plant with **standard industrial equipment**



Simple Introduction to each Sub-system

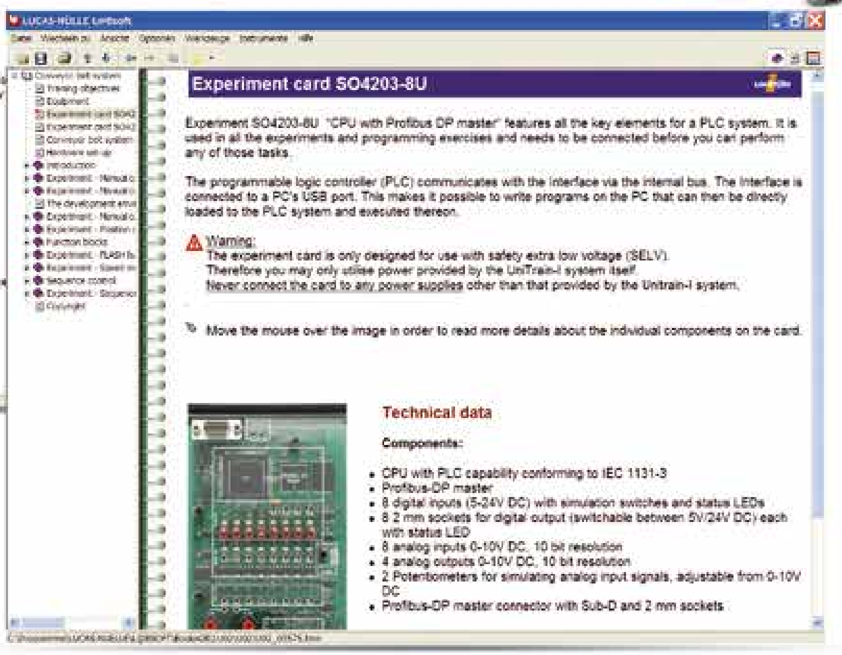
Learning with the Multimedia-based UniTrain-I Courses

The UniTrain-I multimedia experiment and training system uses informative text, graphics, animations and knowledge tests in clearly structured course software to guide students through the experiments. In addition to the training software, each course comes with an experiment card including a control unit on which the practical exercises can be performed.

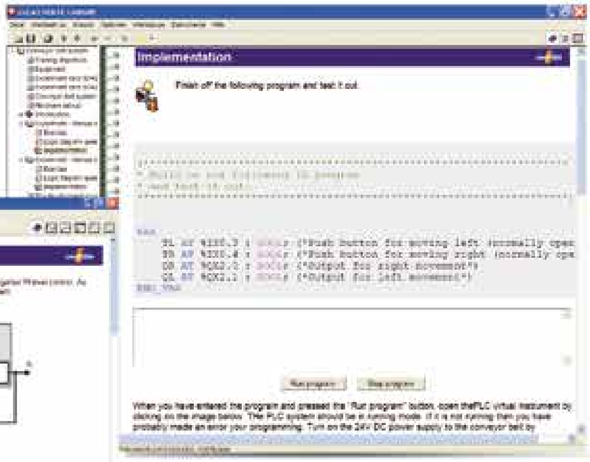
Your benefits

- Educationally designed implementation and operation of all conveyor belts and sub-systems
- Integration of both cognitive and "hands-on" training material
- Strong linkage between theory and practice
- Rapid learning progress thanks to structured course design
- Extremely rapid setup and assembly
- Courses structured into:
  - Training objectives/content
  - Hardware description
  - Software description
  - Basic knowledge
  - Experiments
  - Fault simulation and knowledge tests

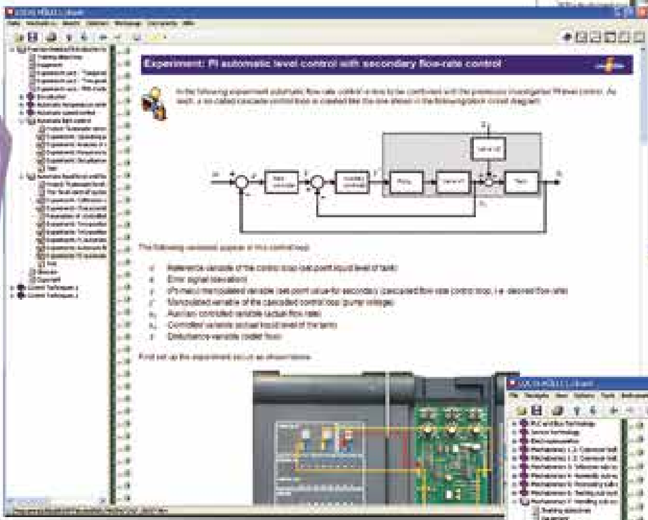
Systematic arrangement of training objectives



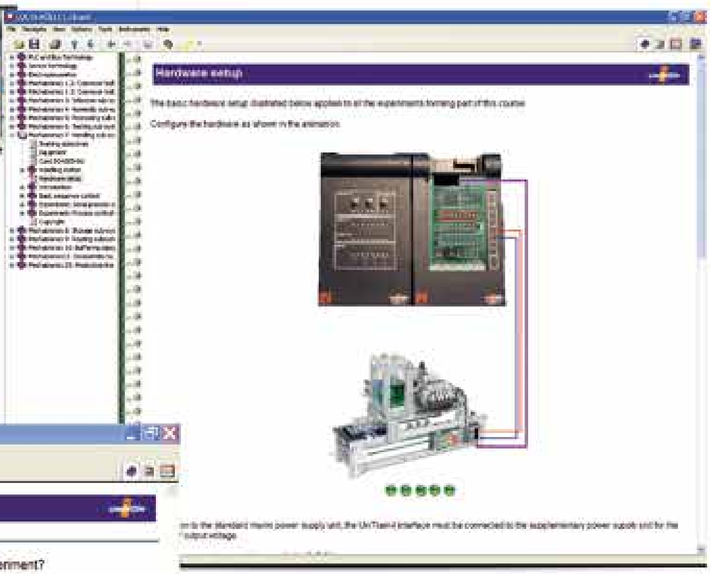
Experiment cards – contain all central elements of a PLC



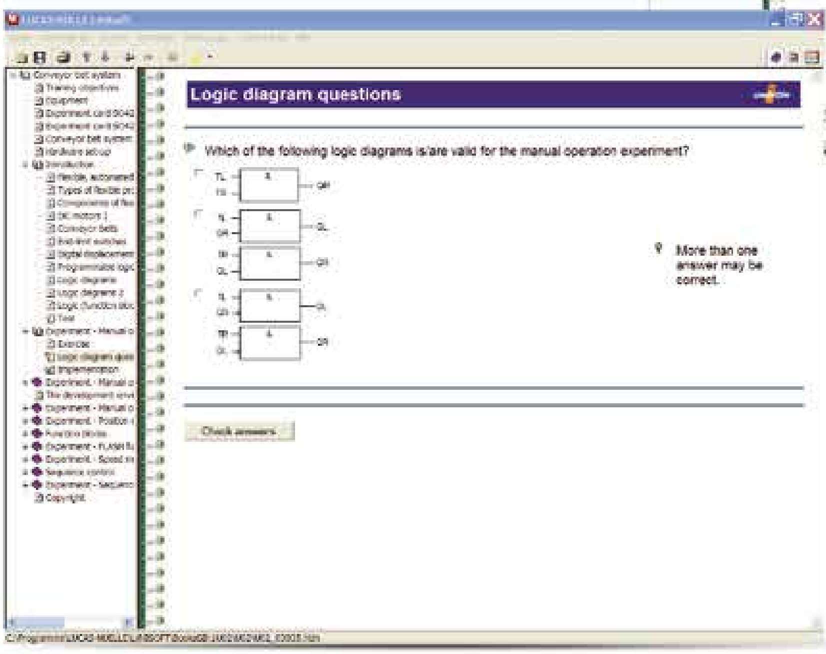
Virtual instruments with graphic evaluation



Comprehensive coverage of theory



Animated experiment setups



Interactive knowledge test

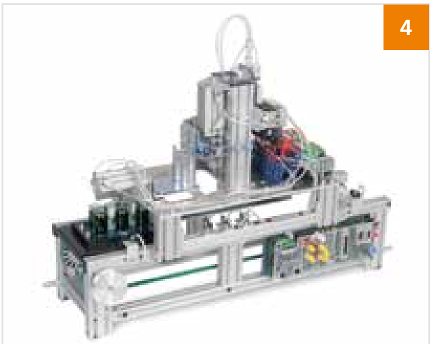
Sub-systems at a Glance

Hands-on Training Guaranteed


1
Compact station


2
Mixing station


3
Filling station


4
Corking station

Suitable stations from the IMS® System


5
Transport


6
Handling


7
Buffering


8
Storage


9
Routing


10
Robotics

IPA Stations

IPA 1 – Compact Station

Professional automatic control of pressure, temperature, volumes and flow rates: The compact station with four integrated controlled systems is the optimum solution for typical production processes in the most varied of industries. The system's modularity permits various configurations to be implemented in the safety of the laboratory environment.

Training contents

- Design, wiring and commissioning of a process engineering plant
- Selection, deployment and connection of different sensors
- Measurement of electrical and process-control variables such as liquid level, flow rate, pressure and temperature
- Deployment and connection of transducers
- Design, assembly and commissioning of control loops
- Analysis of controlled systems and control loops
- Putting continuous and discontinuous controllers into operation
- Setting parameters and optimising P-action, PI-action and PID-action controllers
- Cascade control
- Design of open-loop and closed-loop programmes
- Operating and monitoring processes
- Inspection, maintenance and repair
- Networking process engineering systems

Your benefits

- Typical process engineering sensors for temperature, liquid level, flow rate and pressure
- Can be expanded using additional IPA stations: mixing, filling and corking
- Activation of the individual controlled systems simply by adjusting the ball valves
- Fast changes to the flow scheme and integration of other components using flexible plug-in system
- Pump controlled either directly or via speed
- Separate operation of the four controlled systems possible
- Direct manual operation without additional devices via simulation switch
- Integrated display of the pressure, flow rate and liquid level variables

IPA 2 – Mixing Station

Mixing formulations: The IPA mixing station allows for precise mixing of pre-defined formulations of two differently coloured liquids. A control system permits accurate dosage and mixing of the components. The finished liquid can be conveyed to a further station.

Training contents

- Setup, wiring and start-up of a process plant
- Selection, application and connection of various sensors
- Measurement of electrical and process variables such as filling level and flow rate
- Formulation control
- Use and connection of measurement transducers
- Setup and operation of control loops
- Analysis of controlled systems and control loops
- Operation of continuous and discontinuous controllers
- Parameterisation and optimisation of P-action, PI-action and PID controllers
- Design of open-loop and closed-loop control programs
- Process handling and monitoring
- Inspection, maintenance and repair
- Networking of process engineering plants

Your benefits

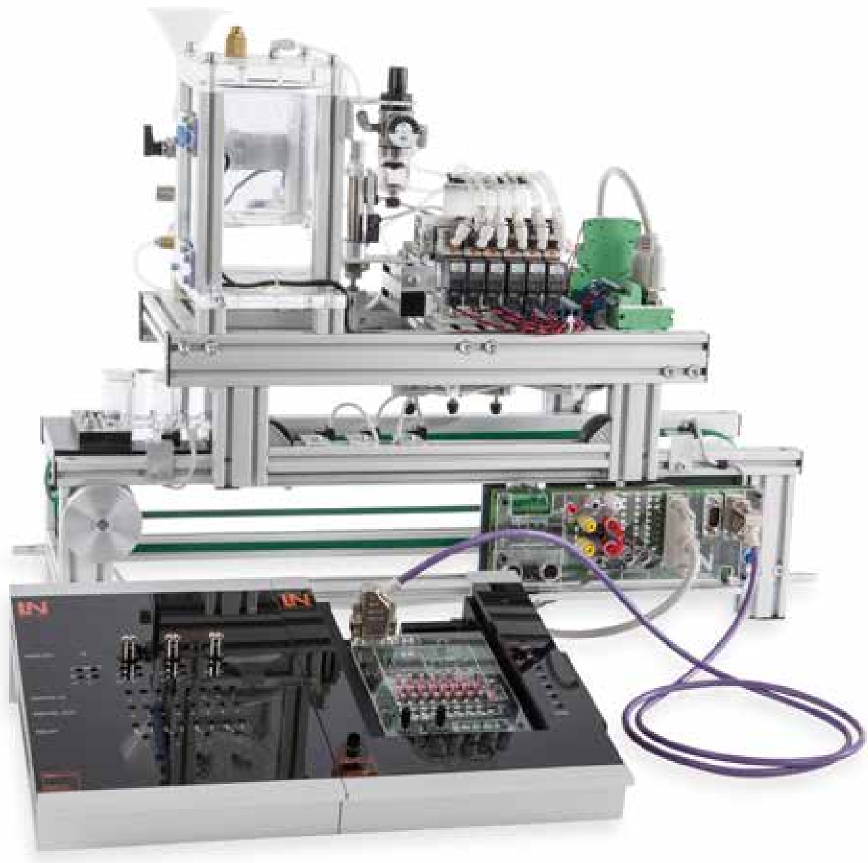
- Typical process engineering sensors for filling level and flow rate
- Can be expanded using additional IPA stations: compact station, filling and corking
- Fast changes to the flow scheme and integration of other components thanks to flexible plug-in system
- Pump controlled either directly or via speed
- Direct manual operation without additional devices via simulation switch
- Optional automatic pH control implementable

IPA 2 equipment set

IPA Stations

IPA 3 – Filling Station

Bottle filling: The IPA filling station is mounted on a conveyor belt and allows the metered filling of several bottles. Six bottles placed on a carrier are positioned below the filling station. The bottles are filled with a coloured liquid to a defined level. Once all bottles have been filled, the carrier is transported to the next station.



Training contents

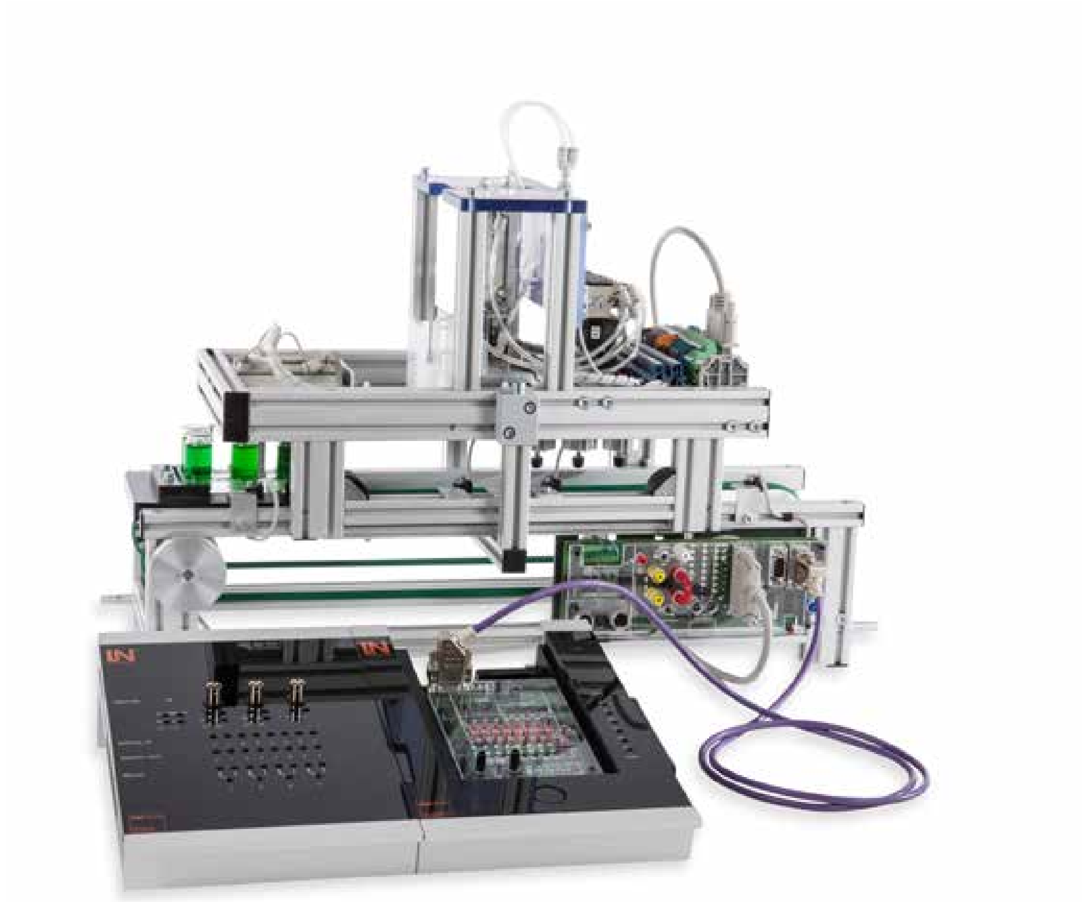
- Setup, wiring and start-up of a process plant
- Selection, application and connection of various sensors
- Measurement of electrical and process engineering variables such as filling level
- Use and connection of measurement transducers
- Design of open-loop and closed-loop control programs
- Process handling and monitoring
- Inspection, maintenance and repair

Your benefits

- Can be expanded using additional IPA stations: compact station, mixing and corking
- Network capable using PROFIBUS DP via the IMS® conveyor belt system

IPA 4 – Corking Station

Bottle corking: The IPA filling station is mounted on a conveyor belt and allows the water-tight corking of bottles by means of plastic caps. Six bottles filled with coloured liquid and placed on a carrier are positioned below the filling station. The bottles are then sealed by means of a pressing cylinder. Once all bottles have been corked, the carrier is transported to the next station.



Training contents

- Setup, wiring and start-up of a process plant
- Selection, application and connection of various sensors
- Use and connection of measurement transducers
- Design of open-loop and closed-loop control programs
- Process handling and monitoring
- Inspection, maintenance and repair
- Networking of process plants

Your benefits

- Can be expanded using additional IPA stations: compact station, mixing and filling
- Network capable using PROFIBUS DP via the IMS® conveyor belt system

From the IPA Station to the Production Line Using IMS®

Advanced Instruction

By assembling a variety of sub-systems, the "Industrial Process Automation" IPA can integrate individual process steps to form a complete production line. This permits the realistic simulation and demonstration of interdependent production processes.

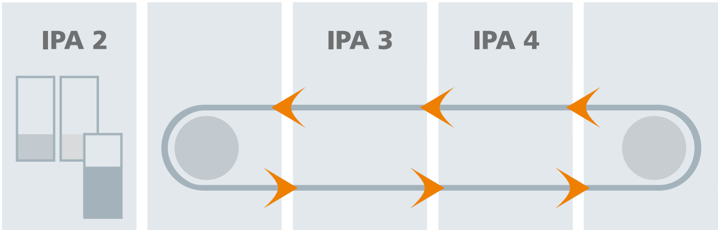
IPA 23 – Production line with 3 sub-systems

IPA 2 – Mixing, IPA 3 – Filling and IPA 4 – Corking

IPA 2 – Mixing
Two differently coloured liquids are mixed in accordance with a prescribed formula to form a new liquid. This finished liquid is then supplied to the filling station.

IPA 3 – Filling
Six bottles placed on a carrier are positioned below the filling station. The bottles are filled with a coloured liquid to a defined level. Once all bottles have been filled, the carrier is transported to the next station.

IPA 4 – Corking
Six bottles placed on a carrier are positioned below the filling station. The bottles filled with coloured liquid are then sealed by means of a pressing cylinder. Once all bottles have been corked, the carrier is transported to the next station.



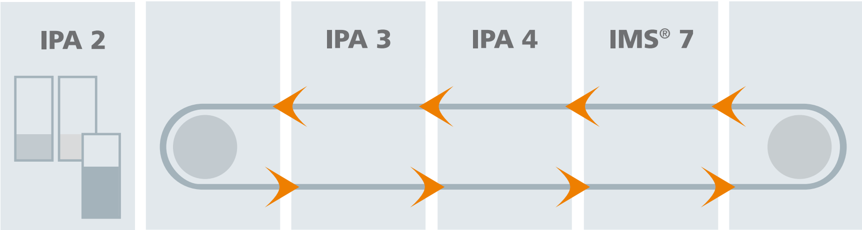
Your benefits

- Thanks to its modular design, seamless integration is quickly implemented into the proven "Industrial Mechatronic System" IMS®
- The modularity of the system permits any number of configurations to be realised in the extremely safe environment of the laboratory
- Optimum solution for typical production processes in the widest range of sectors
- Individual configuration of the single subsystems to make up a fully-fledged and customised production plant in keeping with specific requirements and space
- A teaching and training system designed to meet any content requirements
- Open for further expansion
- Integration of a carrier return system possible

IPA 24 – Production line with 4 sub-systems

IPA 2 – Mixing, IPA 3 – Filling, IPA 4 – Corking, IMS® 7 – Handling

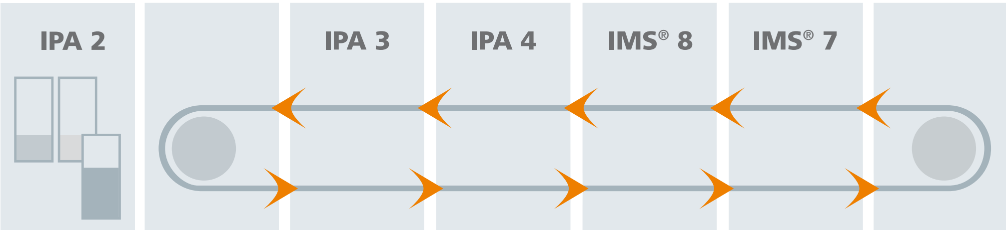
As per IPA 23, plus:
IMS® 7 – Handling
After corking, the workpiece carrier is moved to a position at the extraction point. The sixpack is placed on the storage location by a robot.



IPA 25 – Production line with 5 sub-systems

IPA 2 – Mixing, IPA 3 – Filling, IPA 4 – Corking, IMS® 7 – Handling, IMS® 8 – Storage

As per IPA 24, plus:
IMS® 8 – Storage
The return system features a storage and retrieval system with twenty storage cells. Sixpacks can be stored on the rack according to the production job. Empty carriers are then returned to the start of the production line.



IPA 26 – Production line with 6 sub-systems

IPA 2 – Mixing, IPA 3 – Filling, IPA 4 – Corking, IMS® 7 – Handling, IMS® 8 – Storage, IMS® 10 – Buffering

As per IPA 25, plus:
IMS® 10 – Buffering
If more than one carrier is on the belt, this sub-system can buffer the flow of materials by employing a lifting unit to raise the carrier off the belt entirely. It can then be replaced on the belt when necessary.

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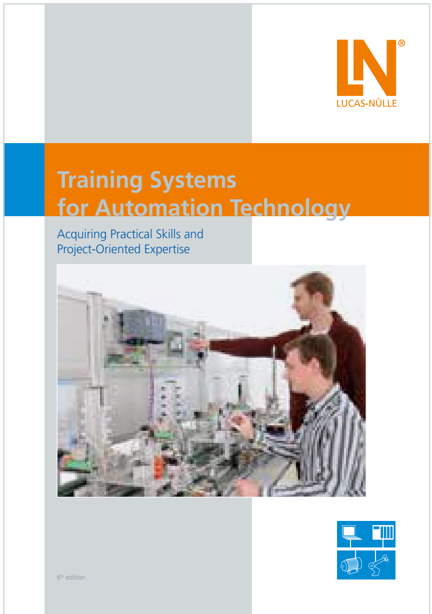
Lucas-Nülle GmbH

Siemensstraße 2 · D-50170 Kerpen-Sindorf
Telephone: +49 2273 567-0 · Fax: +49 2273 567-39
www.lucas-nuelle.com · export@lucas-nuelle.de



Further information can be found in our Automation Technology catalogue.

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