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Automation | Industry 4.0

Acquire practical and project-oriented laboratory skills and expertise:

Automation trainers, mechatronics trainers, PLC trainers

Robotics

Robotics

Robots play a key role in modern, highly automated and efficient production processes. The experiment sets for robotics technology guide automation or mechatronics engineers of the future step by step from the fundamentals, through handling the equipment and on to programming of robots. It also demonstrates optimised interaction with automated plant.

Benefits to you:

- Simple introduction to robotics
- High-precision training robot
- It is possible to work with the training robot without the need for protective measures such as a safety door or light curtain
- Professional 3D software for online and offline programming
- Industry-like, text-based programming capability with extensive functionality
- Easily understood graphical programming tool
- Easy connection and communication with a PLC system
- Easy transfer and introduction to industrial robots

CCR 1 Collaborative 6-axes robot arm

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The 6-axes robot arm does not need a protective cage or zone. The collaborative properties of the arm permit safe operation with the robot without any protective safety measures. The force-disabling sensitivity is adjustable.

The assembled two-finger gripper can be incrementally open and closed with precision. The gripping force used to grasp objects can also be set separately and variably for each project. This makes it deployable for a host of different project tasks.

With its integrated camera system, the collaborating robot can reliably detect the shape and location of objects and then grip these objects at predetermined positions. The robot automatically adapts itself to the new location depending on where the object being gripped is.

Equipment set comprising the following:

Pos.	Product name	Bestell-Nr.	Anz.
1	**Collaborative 6-axes robot arm with camera and gripper**	LM9591	1

The system is comprised of a collaborative 6-axes robot arm with electrically operated gripper and integrated camera system. The robot can be rapidly programmed without any prolonged initiation period. It is also easy to set up and is both collaborative and safe. Thanks to its intuitive software, even inexperienced operators can quickly learn the fundamentals of programming. Desired path points can be traversed and saved either by using the teach pendant or the manual guide function. In manual guide mode the robot arm can be moved by hand directly into the desired position.

Technical data:

- Working radius: 500 mm
- Carrying load: 3 kg
- Repetition accuracy: +/- 0.1 mm
- Control operation: 12" touchscreen with a user-friendly graphically designed interface.
- Degrees of freedom: 6 rotating joints
- I/O interfaces: 16 DI, 16 DO, 2 AI, 2 AO
- Electric gripper: Adjustable gripping power 3 N up to 40 N, stroke up to 110 mm
- Camera system: maximum resolution: 5 Mpx (2560 x 1920), maximum image frequency: 30 fps
- Safety: functional safety test approved by TÜV NORD in accordance with: EN ISO 13849:2008 PL d

| 2 | **Aluminium profile mechatronics trolley for collaborative robot arm, 600mm x 900mm (WxD)** | ST7200-3G | 1 |

High-quality, mobile experiment and demonstration trolley from the SybaPro range with aluminium profile legs compatible with all add-ons and extensions for the SybaPro system.
It allows for the attachment of a collaborative 6-axis robot arm. Another possible enhancement which may be attached is a mechatronic conveyor belt system with a processing station. This makes it possible to complete multiple projects.
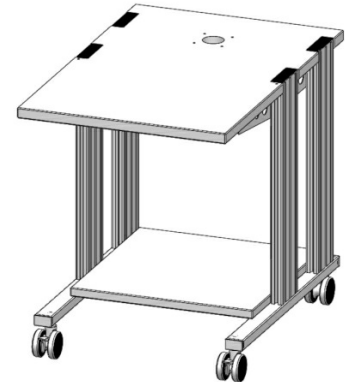
- Side pieces made up of extruded aluminium profile with multiple grooves
- 8 Identically sized grooves in the extruded aluminium profiles (3 on each face and one down each edge)
- Grooves accommodate standardised industrial mountings
- Compatible with all extensions in the SybaPro range (e.g. monitor holders, lighting etc.)

- 2 Natural brushed, H-shaped aluminium profiles to accommodate training panels of standard A4 height underneath the tabletop
- Inward-facing brush strips ensure protection of the training panels and allow plug connections to be swapped over without noise during experiments

- Base of table made of rectangular aluminium tubing with four steerable double casters, two with brakes
- Table frame made of stable rectangular tubing combination running around all four sides
- Four steerable double casters, two with brakes
- Acid-resistant epoxy-resin coating of thickness 80 µm approx., colour RAL 7047
- Suitable for placing beneath a 3 HU power supply energy duct

- Tabletop 600x30x900 mm, base board 525x30x525 mm (WxHxD)
- Highly compressed, multi-layer chipboard conforming to DIN EN 438-1, colour light grey, with slightly textured laminate coating of thickness 0.8 mm (Resopal) conforming to DIN 16926 on both sides
- Tabletop edged with solid, impact-resistant edging made of 3-mm thick coloured plastic, colour RAL 7047
- Coating and adhesives are PVC free
- Built-on switchable socket strip with 5 sockets
- Height of tabletop 760 mm
- Overall dimensions 600x900x760 mm
- Supplied as kit for self-assembly

Project equipment set "Testing" for industrial robots, consisting of:

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Pos.	Product name	Bestell-Nr.	Anz.
3	**Testing station**	LM9684	1

A testing station that checks workpieces on a conveyor belt for material and colour.

- 4 Binary testing sensors (2 x optical, inductive, capacitive)

- Magnetic end-limit sensor

- Two-way stop cylinder

- 4/2-way valve

- PLC interface: 25-pin SUB-D connector

- PLC requirements: 1 x digital output, 5 x digital inputs
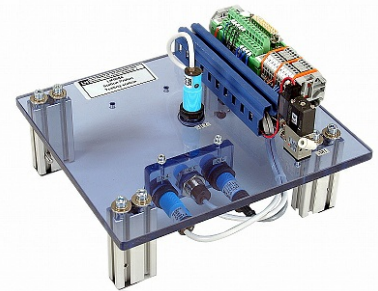
To assure functionality and a long working life for pneumatic components and controls, a maintenance unit is required, consisting of: filters, pressure control valve with pressure gauge and lubrication.

Pos.	Product name	Bestell-Nr.	Anz.
4	**Cyber-physical Conveyor System**	LM9515	1

Mechatronics base module is driven by a variable-speed, 24-V geared motor. Two end-limit sensors are located at each end of the belt. For fundamental experiments with a conveyor belt or for inclusion in a complex mechatronics system for controlling the flow of materials. A Siemens PLC system mounted on the front of the belt module can be programmed in any way and handles the control of the module. The conveyor belt transports workpiece carriers and their workpieces, linking together individual processing stations. It can also be combined with other belts, curve segments or transfer nodes. Processing stations connected to the belt can be controlled by the PLC system via the 25-pin D-Sub port. The conveyor belt together with its control system forms a compact unit. The system can easily be separated from an overall production line and used as an individual workstation without any complex rebuilding or changes to the wiring. This also obviates the need for rearranging tables or the complicated business of removing them from a set-up.

Using an integrated switch it is possible to network several transport systems together with no particular effort. PROFINET cables can be looped from one transport system to the other. The individual systems

do not all have to be separately connected to a central switch. Thus, having to cope with thick cable harnesses and the laying of cables are dispensed with.

An integrated module is used for the measurement and evaluation of the entire system's power and energy consumption (transport system, control unit and optional stations). These values permit an assessment of the energy efficiency and provide information as to how to optimise them. They can be transmitted via LAN to master control centres, where energy management is implemented.

- Length = 600 mm, width = 160 mm, gauge = 120 mm
- Geared motor, 24 V DC
- To control belt movement with variable speed, the PWM signal of the PLC can be used
- 2 magnetic field end-limit sensors
- 3 three-pole terminals for connection of digital sensors
- 25-pin D-Sub port for connection of processing stations
- 2 x M12 ports each with a digital input and output for communication with other conveyor belts
- 2 x RJ45 ports on the front side. The PLC is already connected to the switch at the rear side
- External power supply via 4-mm safety sockets or co-axial power connector
- Incremental encoder disc for position detection and speed measurement via optical sensor
- Control system used: S7-1214 DC/DC/DC with 14 digital inputs and 10 digital outputs
- Additional communication module with 2 digital inputs and 2 digital outputs
- Measurement of power and energy consumption
- Top-hat rail for expansion of PLC system with additional analog or digital I/O modules
- The PLC system can be expanded by means of a PROFIBUS master module or an AS-i bus master module
- 1 x RJ45 cable
- 1 x Step 7 basic with current version of TIA Portal

Warning: Only suitable for schools and training centres -**not** suitable for commercial sector

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5 **DC power supply 24V/5A for IMS conveyor belts**   LM9672   1

Mains power to supply 24 V consumers.

- Input voltage range: (85 - 264) VAC
- Input frequency range: (47 - 63) Hz
- Output voltage: 24 V DC
- Maximum output current: 5 A
- Maximum power: 120 W

| 6 | **25-pin serial interface cable, Sub-D plug/socket** | LM9061 | 1 |

25 pin Sub-D connection cable

- Length: 2m

- Connection: 25-pin plug / 25-pin socket

- Pin assignment: 1:1

| 7 | **Workpiece transport pallet** | LM9520 | 1 |

Pallets for carrying and transporting workpieces on conveyor belts. The pallet has a 4-bit identification code.

- Length = 180 mm/7,1", width = 119 mm/4,7",
- height = 15 mm/0,6"
- Position sensor
- 4-bit identification code

| 8 | **Workpiece, top section, white** | LM9521 | 1 |

- Material: plastic

- Colour: white

- Magnetic clip for attachment to bottom section

- Spring-loaded bearing for attaching bolt

- Dimensions (L x W x H): (100 x 50 x 40) mm/ 3,9" x 1,97" x 1,57"

| 9 | **Workpiece, top section, black** | LM9522 | 1 |

Material: plastic

- Colour: black

- Magnetic clip for attachment to bottom section

- Spring-loaded bearing for attaching bolt

- Dimensions (L x W x H): (100 x 50 x 40) mm/ 3,9" x 1,97" x 1,57"

| 10 | **Bolt workpiece, plastic, red** | LM9528 | 1 |

- Material: metal
- Diameter: 20 mm / 0,79"
- Length 50 mm / 1,97"

| 11 | **Bolt workpiece, metal** | LM9527 | 1 |

- Material: plastic

- Diameter: 20 mm / 0,79"

- Length 50 mm / 1,97"

| 12 | **Workpiece, bottom section, white** | LM9524 | 1 |

Material: plastic

- Colour: white

- Magnetic clip for attachment to top section

- Dimensions (L x W x H): (100 x 50 x 40) mm/ 3,9" x 1,97" x 1,57"

| 13 | **Workpiece, bottom section, black** | LM9525 | 1 |

- Material: plastic

- Colour: black

- Magnetic clip for attachment to top section

- Dimensions (L x W x H): (100 x 50 x 40) mm/ 3,9" x 1,97" x 1,57"

Media:

| Pos.	Product name	Bestell-Nr.	Anz.
14	**Interactive Lab Assistant: CCR 1 Putting a Collaborative Robot into operation**	SO2800-4T	1

The experiment instructions are in the form of an Interactive Lab Assistant course. This multimedia course guides students step by step through the topics of collaborative robots. The technological fundamentals are conveyed by means of easily understood illustrations and animations.

Features:

- Questions with feedback and evaluation logic for assessing student progress
- Printable document so that it is easy to print out the experiment instructions and solutions
- CD-ROM with Labsoft browser and course software
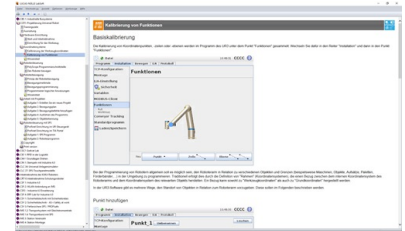
| 15 | **Interactive Lab Assistant: IMS 1.5 Conveyor Belt with PLC and Processing Stations** | SO2805-5N | 1 |

Experiment instructions take the form of an Interactive Lab Assistant course. This multimedia course guides students step by step into the subject of how to program a conveyor belt for specific applications. The basics are conveyed by means of easily understood images. In conjunction with its test question platform, Interactive Lab Assistant forms an extensive experimenting environment.

Features:

- Interactive experiment set-ups
- Measurements and graphics can be saved directly to the
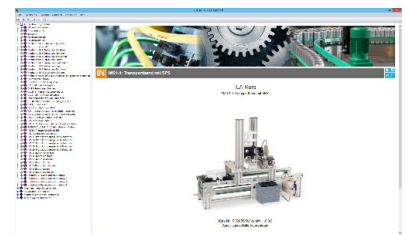
experiment instruction pages by means of drag and drop
- Questions with feedback and assessment logic for checking student progress
- Printable document for easy printing of experiment instructions complete with solutions
- CD-ROM with Labsoft browser and course software

Training contents:

- Belt control
  - Setting up a TIA project
  - Experiment: Inching operation
  - Experiment: Inching operation with shut-off at end limit
  - Experiment with return movement
  - PWM signals
  - Experiment: Control featuring various speeds
  - Position tracing
  - Speed control
- Optional: Hand-held remote control
  - Interface assignments
  - Experiment: Inching operation with hand-held remote control
  - Experiment: End-limit shut-off with hand-held remote control
  - Experiment with return movement
  - Experiment featuring various speeds with hand-held remote control
  - Position tracing
  - Speed control
- Automatic detection of operating stations
- IMS 3 – Sorting station
  - Interface assignments
  - Control
- IMS 4 – Assembly station
  - Interface assignments
  - Control
- IMS 5 – Processing station
  - Interface assignments
  - Control
- IMS 6 – Testing station
  - Interface assignments
  - Control
- IMS 7 – Handling station
  - Interface assignments
  - Control
- IMS 10 – Buffering station
  - Interface assignments
  - Control
- Course duration: approx. 16 h

16 QuickChart IMS 1.5 Cyber-physical conveyor belt system

Short documentation covering the putting into operation of complex equipment and experiment set-ups.

- Terminal assignment, safety instructions, help

- Circuit and assembly diagrams

- Color print in DIN A3 format

- Laminated: 2 x 250 µm