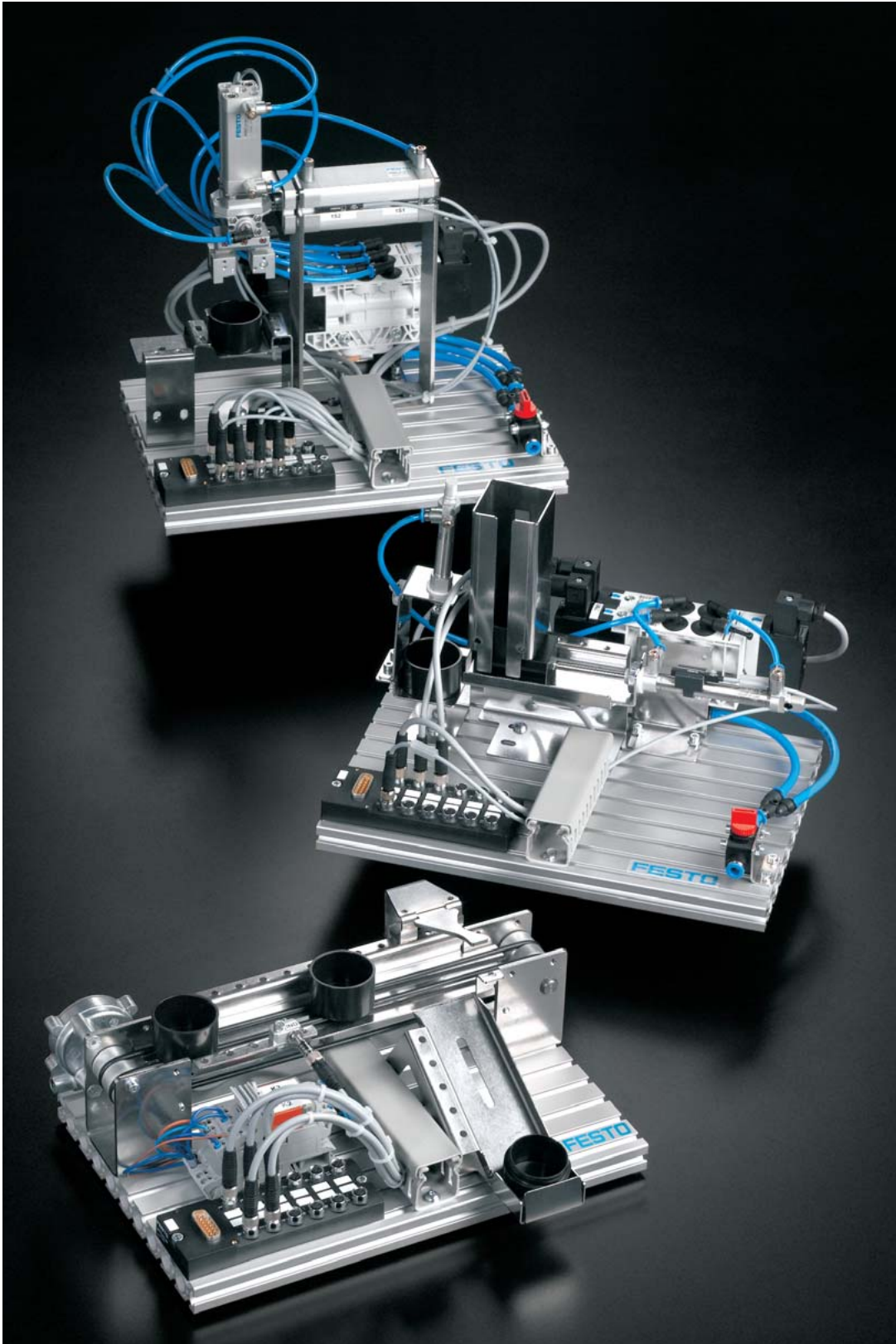# MecLab®
Mechatronics Training System

Amtek Company
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Arnold, MD 21012
800.926.8359 (Ph.)
410.315.9249 (Fax)
info@amtekcompany.com

FESTO

MecLab®
Mechatronics Training System

MecLab® Hardware
Stack Magazine Station
Conveyor Station
Handling Station

MecLab® Accessories
Control Packages
Extension Options

Complementary Media
Software and Courseware

MecLab® and STEM

Creating and Effective
Learning Environment

www.festo.us/technologyforschools

MecLab® Mechatronics Training

Automation Training System

Automated systems are found in almost every industry today. With Festo MecLab, students gain insight into the use of automation technology in a production environment.

The three MecLab stations represent simplified models of typical production processes found in most automated factories.

Learning Objectives

MecLab covers a variety of topics and objectives including:

- Introduction to industrial automation technical terms
- Planning, developing, and building automated systems
- Technical documentation
- Building models and creating simulations
- Open and closed-loop control systems
- Pneumatic and electrical actuators, sensors and controllers
- Using computers as tools for programming and simulation

Realistic and Challenging

MecLab replicates industrial production processes using only industrial components.

The system includes a range of exercises designed to challenge the student in a "hands-on" environment of constructing, modifying, and programming an automated Mechatronic system.

All necessary tools and hardware required for making modifications are included. Wiring of the electrical components is simple, using standard industrial connectors.

Modular and Flexible

MecLab stations can be used individually. Each station performs a practical function and safely demonstrates the characteristics of a fully automated process.

The stations can be joined together to form more complex "production lines".

Students can take on the role of engineer and design special exercises and projects, including joining the three stations together to form a mini production line.

The MecLab® System

MecLab® Hardware

Each system is delivered in its own storage unit fully assembled and ready for immediate use.
It is sturdy and capable of withstanding the rigors of a school environment.

There are three different functions:
1 **Conveyor Station:** Transports and sorts the parts.
2 **Stack Magazine Station:** Stores, feeds, and presses the part.
3 **Handling Station:** Uses a pneumatic gripper to pick up the part and deposit each at pre-defined point.
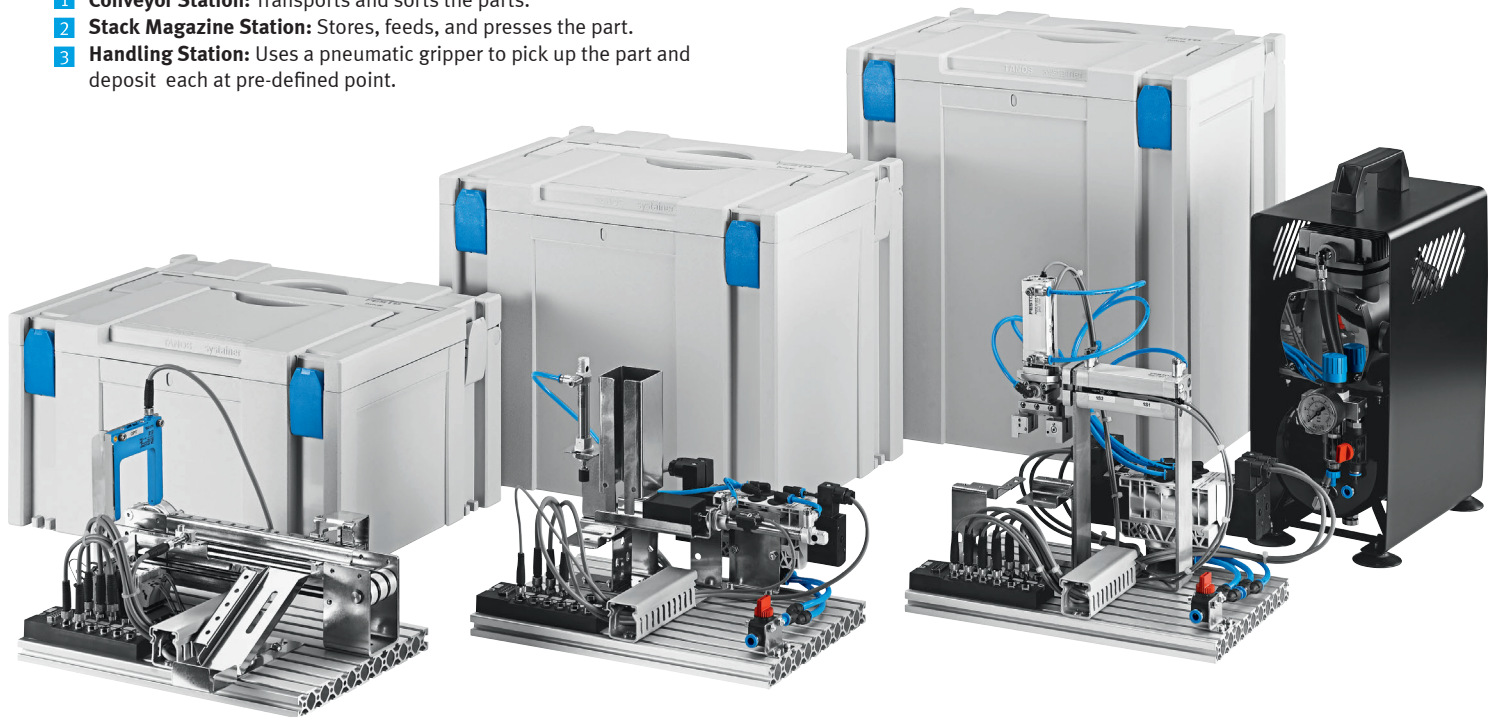
1 **Conveyor Station**   2 **Stack Magazine Station**   3 **Handling Station**

The Complete Package
Contains everything you need for working with MecLab:

- Stack Magazine Station
- Conveyor Station
- Handling Station
- Compressor
- 3 EasyPorts
- 3 Power Supplies (24 vdc)
- 18 FluidSIM Software
- Documentation on CD-ROM
- Work pieces
- Tools
- Hardware set
- Storage Containers

Order no.	556276

Documentation on CD-ROM
The system includes a CD-ROM with:

- **Start-up Instructions**
  Detailed step-by-step instructions show how to connect the stations to the computer and how to write simple programs. Suggestions for lesson planning are included.
- **Textbook (Electronic Version)**
  Explains the basics of pneumatics, electrical engineering, electrical actuators, sensors, and control technology.
- **Workbook (Electronic Version)**
  Contains 5-7 exercises per station, prepared worksheets in *.doc format, and exercise solutions.
- **PowerPoint Presentations**
  Also includes videos and technical data for all components.

Control with FluidSIM® Software
The stations are controlled with FluidSIM for MecLab software and the EasyPort interface.

- FluidSIM is used for creating and simulating pneumatic, electrical circuits and programmable logic controllers. With its universal PC interface, FluidSIM can directly control each MecLab station.
- Students are able to create and simulate an electro-pneumatic circuit then create a control program for the MecLab station.
- FluidSIM is supplied as a school license for six seats.
- Students can run exercise solutions via software simulation before testing them on the station.
- The software provides information at the click of a mouse about all components and includes informative and animated sequences.

MecLab®
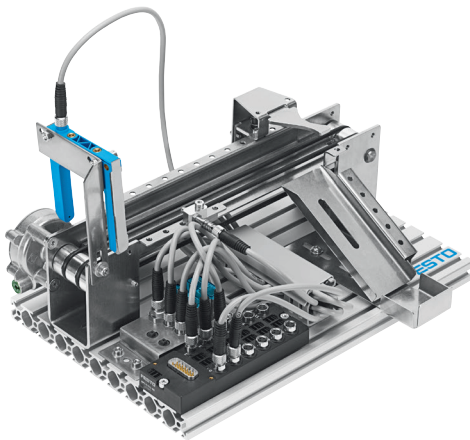# The Stacking Magazine and Conveyor Stations
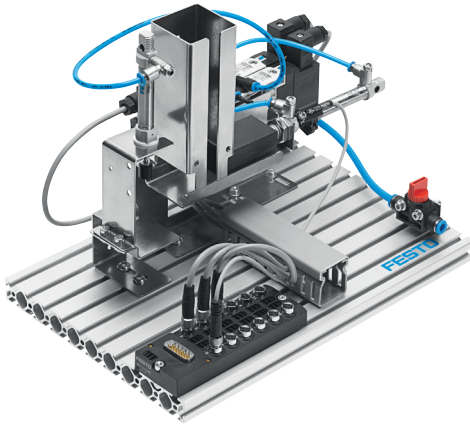
1 Stack magazine station

Order no.	**548704**

Accessories (not included)
Control package

Order no.	**549787**

Compressor

Order no.	**556275**

2 Conveyor station

Order no.	**548705**

Accessories (not included)
Control package

Order no.	**549787**

1 Stack Magazine Station

Function

In an automated production line, work pieces are stored and fed into the process in a timed sequence. This is the function of the MecLab Stack Magazine Station. It stores, transfers,and presses each work piece.

Work pieces stored in the stack magazine are pushed out by a horizontally positioned cylinder. A second, vertically positioned cylinder replicates a press-fit process (e.g., pressing a lid onto a can).

All processes are controlled electro-pneumatically. The included magnetic reed switch can be used to verify the position of a cylinder.

Technical learning objectives

— Basics of pneumatics
— Single-acting cylinders
— Double-acting cylinders
— Solenoid valves
— Sensor technology
— Pneumatic plumbing
— Electrical wiring
— Relay control systems

Scope of delivery

— Stack magazine module
— Press-fit unit module
— Multi-pin plug distributor
— 2 solenoid valves
— 2 cylinders
— 1 magnetic reed switch
— Aluminum profile plate
— Tool set
— Work pieces
— Storage container
— Equipment trays
— CD ROM containing all documentation
— FluidSIM®software

2 Conveyor Station

Function

In many production assembly lines work pieces are transported between "process stations" via conveyor belts.

The conveyor station in MecLab provides realistic simulation of an industrial workpiece transport system. The drive motor can be made to run forward and in reverse. Work pieces are detected, classified, and sorted by color.

Technical learning objectives

— Control of direct current motors
— Inductive sensors
— Optical sensors
— Relay circuits
— Polarity reversal circuits
— PLC programming
— Control using logic operations
— Construction and wiring

Scope of delivery

— Conveyor belt module with DC motor
— Solenoid as stopper/deflector
— Multi-pin plug distributor
— Inductive sensor
— Optical sensor (light barrier)
— Aluminum profile plate
— Tool set
— Work pieces
— Storage container
— Equipment trays
— CD ROM containing all documentation
— FluidSIM® software

MecLab®
The Handling Station
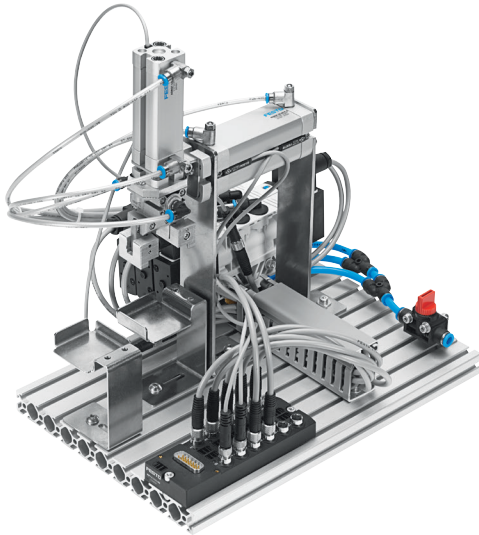
3 Handling station

Order no.	**548706**

Accessories (not included)
Control package

Order no.	**549787**

Compressor

Order no.	**556275**

3 Handling Station

Function
Whether it's a simple pick & place operation or highly complex assembly work – handling systems are always involved. Handling devices range from simple, two-axis systems to highly complex industrial robots with six axis.

The Handling station in MecLab consists of pneumatic cylinders with simple bearing guides and two axis. The work piece is held by a pneumatic gripper. The system can be used to transport the work piece between stations or to join two work piece halves together.

Technical learning objectives
— Basics of pneumatics
— Double-acting cylinders
— Grippers
— Solenoid valves
— Sensor technology
— Pneumatic plumbing
— Electrical wiring
— Relay control systems
— Logic control
— PLC controllers
— Sequencing operations

Scope of delivery
— Handling module
— 3 solenoid valves
— 4 magnetic limit switches
— 2 pneumatic cylinders with simple bearing guide
— 1 pneumatic gripper
— Multi-pin plug distributor
— Aluminum profile plate
— Tool set
— Work pieces
— Storage container
— Equipment trays
— CD ROM containing all documentation
— FluidSIM® software

4 MecLab® Expansion set

Order no.	**556245**

4 MecLab® Expansion Set

This expansion set contains a range of components for realizing your own project ideas. All in a practical Systainer, of course.

Content
– Two double-acting cylinders with one-way flow control valves
– 2 solenoid valves
– 1 diffuse sensor
– 2 magnetic limit switches
– 1 profile kit
– 1 profile plate
– 1 electrical button
– 1 electrical switch
– 1 indicator light

MecLab®
Compressors and power supply units

1 Compressor for MecLab®

Low-cost compressor for MecLab®. Only 54 DB (A), therefore well suited for use in classrooms. Supplies up to 4 stations.
– Pressure: max. 400 kPa (4 bar)
– Suction capacity: 14 l/min
– Reservoir capacity: 2,5 l
– Dimensions: 310 x 150 x 370 mm

Design: 110 V/60 Hz, 70 W
With mains cable suitable for:
US, CA, Central America, BR, CO, YU, EC, KR, TW, TH, PH, JP

Order no.	556275

2 Compressor

Oil-lubricated, extremely quiet (45 dB (A)) compressor. Ideally suited for use in classrooms. With pressure regulator and water separator. Supplies up to 8 stations.
– Pressure: 800 kPa (8 bar)
– Performance: 50 l/min
– Reservoir capacity: 25 l
– Compressed air outlet: ¼"

Design: 100 – 120 V/50 – 60 Hz
With fully insulated socket

Order no.	565440

Necessary accessories

Main cable	

Accessories:
Coupling socket, coupling plug, tubing

Order no.	102725

3 Tabletop power supply unit
– Input voltage: 85 – 265 V AC (47 – 63 Hz)
– Output voltage: 24 V DC, short-circuit-proof
– Output current: max. 4.5 A
– Dimensions: 115 x 155 x 200 mm

Without power cable

Order no.	162416

With power cable, 1.3 m, suitable for:
US, CA, Central America, BR, CO, EC, KR, TW, TH, PH, JP

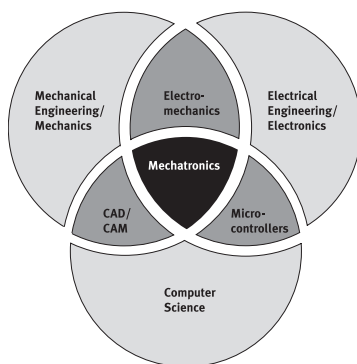| Order no.	162418

4 Power cable
One side designed as a connector and one side with a country-specific plug.
US, CA, Central America, BR, CO, EC, KR, TW, TH, PH, JP

Order no.	350362

Mechatronics

Mechatronics is the synergistic combination of mechanical engineering, electrical engineering, electronics, information technology, and systems thinking, utilized in the design of products and automation processes.

Festo Learning Systems products provide the ideal environment for Mechatronics training.

Technical training objectives include the ability to:
• Analyze functional relationships in mechatronic systems
• Manufacture mechanical components
• Follow information and energy flow in electrical, pneumatic, and hydraulic sub-systems
• Plan and organize work flow
• Commission, troubleshoot, and repair mechatronic systems
• Communicate using industrial network protocols, including DeviceNet™and ProfiBus

MecLab®
Control Options
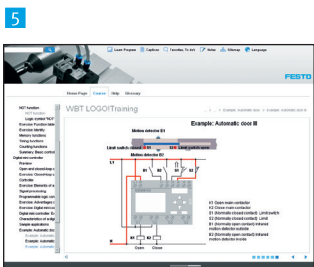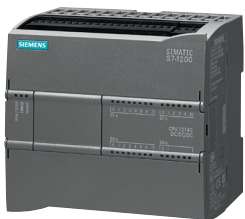
1 The control package
EasyPort Mini with power supply unit and connecting cables
The control package contains everything you need for controlling MecLab®:

EasyPort Mini
– 6 digital input and output channels
– Maximum current per output channel 0.7 A, 24 V
– Digital input switching threshold 12 V
– Power supply 24 V DC ±10 %, 3 VA power consumption
– Status LED to indicate the operating status
– USB interface to connect to a PC via mini USB socket
– Including USB connecting cable
– Short circuit proof

Power supply unit
– 24 V DC output voltage
– output current max. 1.88 A
– supply voltage 100 – 240 V, 1.5 A, 50 – 60 Hz
– Short circuit proof

Order no.	549787

Necessary accessories

Power cable ➔ Page 6	

2 LOGO! Trainer Package 24 V
FluidSIM® contains a software-based minicontroller, e.g. as an introduction to the LOGO!, the minicontroller from SIEMENS. We offer an attractively priced set of 5 LOGO! modules.
For industrial colleges and training centers.

Package includes:
– Set of 5 LOGO! 12/24RC
– Programming software LOGO! Soft Comfort
– 1 USB programming cable

Order no.	556235

Set of 4 LOGO! USB PC cables
(without illustration)

Order no.	556237

3 Connecting cable
Connecting cable with 15-pin sub-D connector and free cable ends.
– For connecting a Logo! to the multi-pin plug distributor of a MecLab® station.
– Connecting cable for the end-position controller SPC 11 with 4 mm safety plugs.

Order no.	177673

4 Trainer Package
   SIMATIC S7-1200 DC/DC/DC
Consisting of:
– 6x SIMATIC S7-1200, CPU 1214C, COMPACT CPU, DC/DC/DC, ONBOARD I/O: 14 DI 24 V DC; 10 DO 24 V DC; 2 AI 0 – 10 V DC or 0 – 20 mA. Power supply: 20.4 – 28.8 V
DC, program/data memory: 50 KB
– 6x SIMATIC S7, STEP 7 Basic, single licence, SW and documentation on DVD, licence key on USB stick, 2 languages (de/en), runs on Win XP, Win Vista
– 6x SIMATIC NET, Ind. Ethernet TP XP CORD RJ45/RJ45, CAT 6, crossed TP cable 4x2, with 2 RJ45 plugs, length 6 m
– 6x SIMATIC S7-1200, simulator module
– 6x SIMATIC S7-1200, analogue output, SB 1232, 1 AO, ±10 V DC or 0 – 20 mA

Order no.	567238

Connecting cable SysLink – Sub-D
(without illustration)
Cable for connection MecLab® stations with sub-assemblies that have a 24-pin SysLink plug.

Order no.	560752

5 Training program LOGO! Training
This training program provides an introduction to logic functions. First of all, AND & OR functions and their processing are shown in function tables. Other basic control functions such as memory, timer and counter functions round off the contents. The second part starts by covering the basics of open-and closed-loop control circuits and describes the elements of a controller. It then takes a detailed look at minicontrollers with their features and areas of application.

From the contents:
– Basic technical functions (AND & OR function, memory function, timer function, counter function)
– Digital minicontrollers (differentiation between open- and closed-loop control)
– Control components
– Positioning with digital minicontrollers
– Design and function of a minicontroller
– Cyclical program processing
– Areas of application
– Programming languages

Training time: approx. 2 hours

E.g. single license on CD-ROM, with online activation DE/EN/ES/FR

Order no.	540941

with network licence connector DE/EN/ES/FR

Order no.	540943

MecLab®
Extensions for sensors

With these components, new functions can be implemented with MecLab®. The perfect extension of MecLab® for project work.

1 Connecting cable between MecLab® stations
Cable data connection between two MecLab® stations. Connects the input channel of one station to the output channel of another station. Length 0.5 m, with two 3-pin M8 plugs.
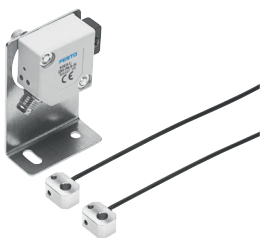
Order no.	549790

2 Sensor/actuator cable M8/M8, 50 cm
Extension cable with 3-pin M8 plug connector or socket for extending sensor or actuator cables.

Order no.	175488

3 Light barrier
Fork light barrier, fork gap 50 mm, complete with connecting cable and mounting accessories.

Order no.	549791

4 Retro-reflective sensor
Fiber-optic diffuse sensor, complete with optical fibers, connecting cable and mounting accessories.

Order no.	549792

5 Inductive sensor
Inductive sensor, cylindrical design with M5 male thread, 0.6 mm sensing distance, complete with connecting cable and mounting accessories.

Order no.	549793

6 Tool set
The tool set is an aid to easy working on stations.
A practical mini-systainer includes:
– 200 mm steel rule
– Open-jawed spanners size 7, 8, 9, 10
– Adjustable spanner
– Side cutter
– Insulation-stripping pliers
– Wire end sleeve pliers
– Screwdriver set, hex, 1.5 – 6
– Screwdriver, hex, 0.9; 1.3
– Screwdriver, cross-head, PZ02 – short
– Screwdriver, flat, 2.5 x 75; 4.0 x 100
– Screwdriver, flat, 1.2 – 1.6
– Tubing cutter
– Fibre-optic cable cutter
– Workpiece, red, black, silver
– 100 x cable binders 2.5 x 100
– 100 x wire end sleeves 0.25
– 100 x wire end sleeves 0.75

Order no.	539767

7 Magnetic limit switch
Limit switch for detecting the pneumatic cylinder piston position, for round and profile cylinders, with connecting cable.

Order no.	543861

8 Mounting of proximity switches on circular cylinders
Kit for magnetic limit switch, Order no. 543861, on circular cylinders.

Order no.	175092

9 Magnetic limit switch for gripper
Limit switch for detecting end positions at the gripper on the Handling station.

Order no.	526679

10 Signal input/output
– 1 electrical button (NO and NC contacts)
– 1 switch
– 1 indicator light each
Complete with mounting materials and connecting cable.

Order no.	556249

MecLab®
Extensions for actuators

1 Stopper/deflector

Solenoid for mounting on both sides of the conveyor, stopper or deflector function, complete with connecting cable and mounting accessories.

Order no.	549795

2 Bistable 4/2-way solenoid valve

Manual override with detent, complete with fittings, silencer, mounting bracket and mounting screws.

Order no.	549803

3 Monostable 4/2-way solenoid valve

Monostable 4/2-way solenoid valve, can be converted to 3/2-way function, manual override with detent, complete with fittings, silencer, mounting bracket and mounting screws.

Order no.	549804

4 Stamping unit

Press-fit unit for attaching to the stacking magazine station or conveyor, comprising single-acting cylinder with 25 mm stoke and 10 mm diameter, complete with one-way flow control valve, mounting bracket and mounting screws.

Order no.	549805

5 Double-acting cylinder

Double-acting cylinder, 10 mm diameter, 50 mm stroke, complete with one-way flow control valves, foot mounting and mounting bolts.

Order no.	556248

6 Vacuum gripper

Handling station vacuum gripper kit as a substitute for the mechanical gripper, complete with vacuum generator, 20 mm diameter suction gripper and mounting accessories.

Order no.	549796

7 On/off Valve

Manually operated valve with 3/2-way function for tubing diameters of 6 mm, complete with mounting bracket and mounting screws.

Order no.	549809

8 T-distributor

T-distributor for plastic tubing, 2 of each for tubing diameters 4 mm and 6 mm.

Order no.	549810

9 Plastic Tubing

4 x 0.75 Silver 10 m	151496
3 x 0.5 Silver 5 m	197118
6 x 1 Silver 5 m	152963

Minimum order quantity/packaging unit quantity: 50 m

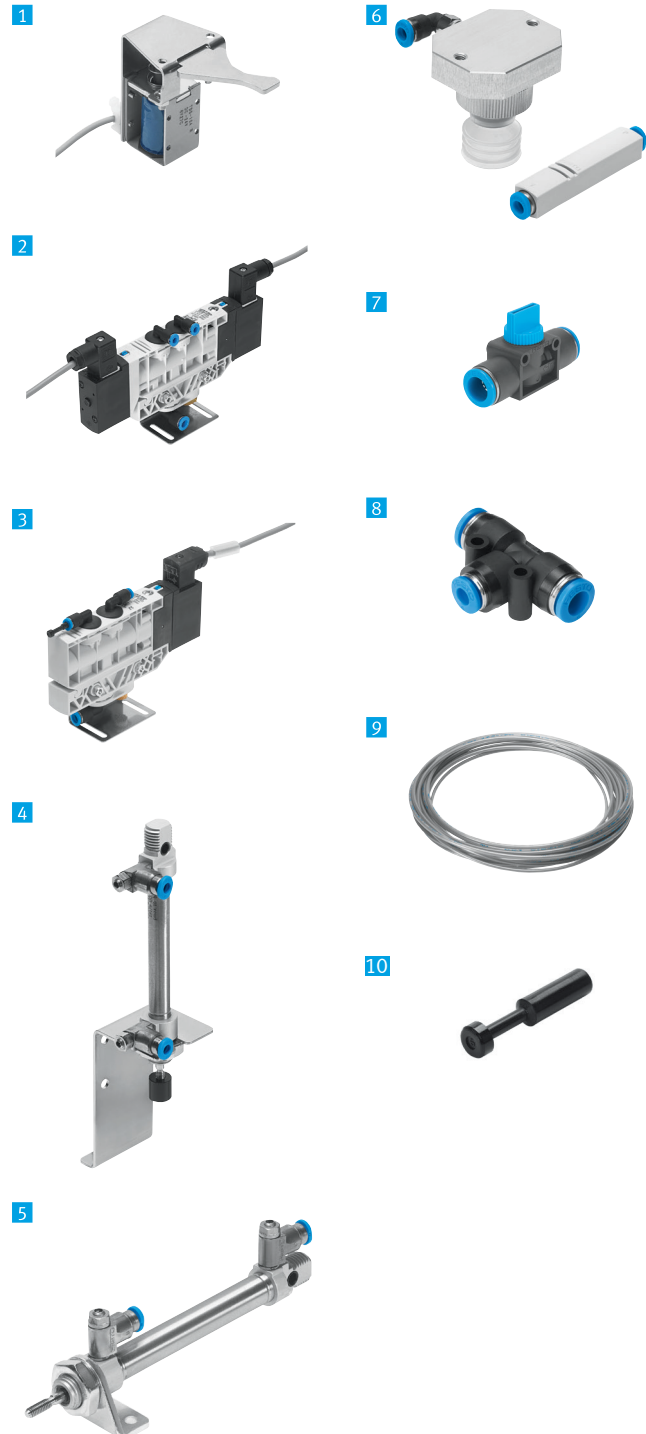| 4 x 0.75 Silver	152584
4 x 0.75 Blue	159662
4 x 0.75 Black	159663
4 x 0.75 Red	178410
4 x 0.75 Yellow	178417
4 x 0.75 Green	178424

10 Blanking plugs

Blanking plug for sealing QS-4 fittings of valves, for example. Nominal diameter 4 – QSC-4H

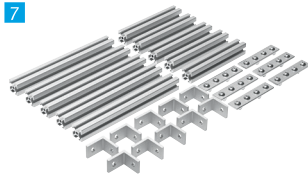Minimum order quantity/packaging unit quantity: 10 pieces

Order no.	153267

MecLab®
Mechanical Components

1 Slide
Slide for transporting or storing workpieces, 40 mm in diameter, for maximum 3 workpieces, mounting surface for sensors and actuators Complete with mounting accessories.

Order no.	549797

2 Tray, low
Holding tray for retaining workpieces 40 mm in diameter and 39 mm in height. Complete with mounting accessories.

Order no.	549798

3 Tray, high
Holding tray for retaining workpieces 40 mm in diameter and 62 mm in height. Complete with mounting accessories.

Order no.	549799

4 Workpiece set
Workpiece set consisting of 6 plastic cans in silver, red and black (2 of each), diameter 40 mm, height 25 mm, and 6 lids.

Order no.	549800

5 Rail
Cover for ejecting opening in the conveyor, length 140 mm, with mounting surface for sensors or actuators. Complete with mounting accessories.

Order no.	549801

6 Profile connector
Connector for two aluminum slotted assembly boards with 20 mm grid dimension. Complete with mounting screws.

Order no.	549802

Screw kit MecLab®
Bag of replacement screws and T-head nuts (without illustration).

Order no.	556255

Rubber ring conveyor
The conveyor belt of the conveyor station is a wearing part and deliverable as a spare part (without illustration).

Order no.	701221

7 Assembly kit
Selection of aluminium profiles, 20 x 20 mm in lengths of 120 and 180 mm. Complete with mounting materials.

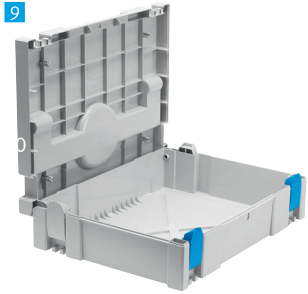| Order no.	556247

8 Profile plate for MecLab®
Profile plate with dimensions 200 x 300 mm, thickness 20 mm, slot spacing 20 mm. Complete with self-adhesive rubber feet.

Order no.	556246

9 Systainer
Stackable interlocking case system, made of light grey plastic with light blue snap fasteners.

Size 0 (Mini-Systainer): 50 x 248 x 158 mm

Order no.	533014

Size 1: 72 x 377 x 277 mm

Order no.	526714

Size 2: 124 x 377 x 277 mm

Order no.	526715

Size 3: 176 x 375 x 274 mm

Order no.	526716

Size 4: 279 x 377 x 272 mm

Order no.	526717

Size 5: 395 x 360 x 272 mm

Order no.	544375

Soft foam insert for lid
(for Systainer sizes 1 – 3)

Order no.	526814

(Interior dimensions W x H x D respectively)

10 Trolley for systainer
Trolley for transporting systainers sizes 1 to 5, can carry up to 5 systainers. With 2 adjustable heights: height 1: 105 cm, height 2: 97.5 cm. Tare weight 4 kg, load bearing capacity 50 kg.

Order no.	549788

11 Dolly truck for systainer
Dolly truck for transporting systainers sizes 1 to 5.
4 castors with a brake.

Order no.	549789

MecLab®
Media Software & Courseware

Software
Excellent resources for:

- Programming
- Experimentation
- Simulation
- Visualization
- Operating and monitoring

To complement the MecLab training system, we recommend the following Web based technology (WBT) programs:

- WBT Fascination of technology
- WBT Pneumatics
- WBT Electro pneumatics
- WBT Sensor technology 2
- WBT Actuators – DC motor
- WBT Open- and closed-loop control

Detailed information and free demo versions available at www.festo-didactic.com

Courseware
Our recommendations for MecLab:

- Textbook: Pneumatics, Basic level
- Textbook: Electro-pneumatics, Basic level
- Textbook: Proximity sensors
- Set of posters on pneumatics

Detailed information, free sample extracts, and online download of curriculum at www.festo-didactic.com

MecLab and STEM
MecLab is designed to support concepts in Science, Technology, Engineering and Mathematics by encouraging students to experiment with computerized control of fluid power devices.

Students solve the same industrial motion control problems that industrial engineers face daily in a production environment. Students will observe and measure electrical and fluid power laws as they design systems to move, assemble, and sort work pieces within the system modules. They will gain the ability to design and evaluate production processes and procedures, based on the efficiency of motion and energy conservation.

Common automation technologies that are part of the MecLab system include pneumatics, PLC logic control, sensor technology, relay control, basic electricity, and DC motor controls.

Learning Systems
Mechatronics Training System

Learning Systems
Modular Production Systems

- Teach Industrial Automation using actual factory processes
- PLCs control working factory models
- Use actual industrial components

Learning Systems
Roadmap to Mechatronics

- Hardware and simulation software to teach mechatronics
- Fluid power, PLC control, robotics and sensors
- ICIM and FMS flexible manufacturing training systems

Headquarters

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Subject to change